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DROOPING FLOWERED CLOVER.

SEED GERMINATION.

G. R. W. MEADLY, B.Sc., Agricultural Adviser.

During the season 1931/32, the germination of Drooping Flowered Clover seed was very low, averaging approximately 6 per cent. with a 94 per cent. hard seed content. By means of scarifying with the Ames hulling and scarifying machine, the germination of seed was increased in bulk quantity from 4 per cent. to over 30 per cent. ("Agricultural Journal," June, 1932). In order to obtain an indication of the germination capacity of new season (1932/33) seed, samples were obtained from a number of farmers. The results of tests carried out proved to be far from satisfactory. Out of six samples, two gave germinations of 2 per cent., two of 1 per cent., and two less than 1 per cent., with correspondingly high hard seed contents ranging from 94 per cent. to 99 per cent.

The fact that these lines were mainly hand-cleaned in order to forward me the samples immediately, would tend to give a slightly lower germination figure than the commercial sample, as the cleaning machine has a mild scarifying effect on the seed. Again, the germination tests carried out in the laboratory are concluded after eight days, thus giving the immediately germinable seeds. In the field, after this time has elapsed, a number of the hard seeds germinate at intervals. Those which do so under favourable conditions thrive and add to the pasture, while those seedlings which are produced out of season usually die.

Despite these two reasons for possible increased germination in the field, however, it is evident that, in order to produce reasonable stands this season, it is essential to increase the germination of the seed. The most practical method available is by means of a scarifying machine, such as the Ames hulling and scarifying machine at present used by the Agricultural Department.

The actual value of the increased germination so produced may be shown clearly by taking a specific example. A bulk quantity of Drooping Flowered Clover seed had its germination increased from 4 per cent. to 35 per cent. by means of scarifying. As there are approximately 1,300,000 seeds per lb., with a normal sowing of 4lbs. per acre, the original sample would be capable of immediately producing 43 plants per square yard under ideal conditions, whereas under similar conditions after treatment 376 plants may be produced. The increased stand thus obtained completely outweighs the slight cost and trouble incurred to produce it.

In order to test whether storage or keeping would affect the germination of Drooping Flowered Clover seed which had been scarified with the above-mentioned machine, I conducted the following series of tests:—On 16/3/32 a group of tests was commenced on the original sample—untreated, and after scarification under different conditions, viz., with seed which had been passed through the machine with the fan running at 2,650 r.p.m., at 2,870 r.p.m., and at 2,870 r.p.m., after the sand paper had been brushed (B in table).

On 6/12/32 a corresponding group of tests was begun and the results obtained are shown in the following table:—

Sample.	Germination.		Hard Seeds.	
	16-3-32	6-12-32	16-3-32	6-12-32
Original	<1	<1	99	99
Scarified (2,650 r.p.m.)	41	50	58	48
A. Scarified (2,870 r.p.m.)	47	58	51	40
B. Scarified (2,870 r.p.m.)	44	57	54	40

From these figures it is evident that little change, if any, took place in the germinating capacity of the original sample, whereas the scarified samples showed increases in germination of 9 per cent., 11 per cent., and 13 per cent. respectively.

The results, therefore, indicate that if the seed is kept under suitable conditions after scarifying in the manner mentioned, Drooping Flowered Clover seed shows an even more improved germination than immediately after scarification. It would thus appear that scarifying should be carried out as early as possible, so as to allow the maximum period between treatment and sowing.

The point to be emphasised is that, for this season at least, all Drooping Flowered Clover seed should be scarified, and farmers are urged to only purchase seed which has been treated. A statement should be obtained from the seed merchant giving the percentage purity and germination of the sample exposed for sale. Good average lines of Drooping Flowered Clover seed have about 85 per cent. pure seeds with an immediate germinating capacity of 35 per cent.

BARLEY SMUTS AND THEIR CONTROL.

H. A. PITTMAN, B.Sc.Agr.,
Plant Pathologist.

INTRODUCTORY.

Owing to the very low prices at present prevailing in Australia for wheat grain, considerable interest is being taken this year by many farmers in this State in the growing of barley, good lines of which have a very much better value per bushel on the English market at the present time than wheat.

As many farmers in Western Australia will not have grown barley before, it has seemed advisable to sound a warning *re* the prevalence of barley smuts in this State, so that no seed will be planted without suitable disinfection, unless it is definitely known, from personal acquaintance with the parent crop, that the seed has been harvested from a disease-free crop well isolated from barley crops affected with loose smut.

TWO DIFFERENT BARLEY SMUTS—"LOOSE" AND "COVERED."

Barley is subject to attack by two distinct smut diseases—one, caused by the fungus *Ustilago nuda*, being known as "loose smut," the other, caused by *Ustilago hordei*, being known as "covered smut." These two diseases can be distinguished from one another by the fact that in the case of "loose smut" the barley head becomes replaced by a very loose mass of smut spores, which readily blow about in the wind, leaving, by harvest time, only a more or less naked rachis or stalk; whereas in the case of the "covered smut" the barley grains, which are replaced by the smut fungus, remain much more solid in consistency, and do not break up to

Fig. 1.—"Loose Smut" of barley due to *Ustilago nuda*, showing progressive stages in the development of smutted heads (from left to right).

After photograph by Office of Cereal Investigations, United States Department of Agriculture, in Cornell Extension Bull. 157 (1927).

anything like the same extent, either while on the plant, or during or subsequent to harvesting. "Covered smut" of barley is, in fact, somewhat similar in appearance to the well-known "bunt," "ball smut," or "covered smut" disease of wheat, except that the infected grains, etc., in the case of barley are transformed into a more or less single unit by remaining firmly attached to the stalk. A point worth bearing in mind, however, is that the barley smuts do not attack wheat or oats, and the wheat and oat smuts do not attack barley, the causal fungi being in each case quite distinct.

METHODS OF INFECTION.

Infection of barley by the "*loose smut*" fungus takes place to a large extent during the flowering period. The already-infected plants throughout the field come into ear usually just a little before the healthy plants, and so, when the black smut spores from them are blown about in the wind, they fall on to the developing flowers of the healthy plants and infect the interior of the grains, *without in any way altering their external appearance.* When these infected grains are planted, however, they give rise to plants which will eventually produce heads affected with "loose smut." A certain amount of infection with "loose smut" of barley also occurs during the germination of the grain and the subsequent early stages of development of the seedling, from spores carried mechanically inside or outside the husks.

With "covered smut" *all* the infection takes place at germination time or during the early stages of development of the seedling, from smut spores present either inside, or outside, the husks.

"Loose smut" of barley does not appear to be very prevalent in this State, but "covered smut" is often very abundant in crops grown from undisinfected ("unpickled") seed.

SEED TREATMENT.

1. *Dipping in Bluestone Solution.*

This is not at all satisfactory, except for skinless barley, with which, of course, the brewer and maltster have no concern. The treatment, however, is given here for the sake of completeness, and in case it should happen that, for some reason or other, a farmer has no alternative but to use it.

The seed is dipped in wheat butts, home-made hessian bags, or other suitable non-metallic containers, into a one-and-one-half to two per cent. (1½-2%) solution of bluestone contained in some non-metallic receptacle, such as a large wooden cask. The solution is made up at the rate of one-and-one-half to two pounds (1½-2lbs.) to every ten gallons of water, the bluestone being readily dissolved by suspending it overnight just below the surface of the water in a small sack or piece of hessian.

The barley grain should be dipped in the solution for three to five minutes, stirring all the while, to cause as much rubbish and smut as possible to rise to the surface. This should be skimmed off with a wooden ladle, or scoop, made of hessian or bagging on a wooden frame, and burnt. The grain should be removed at the end of three to five minutes and drained for ten minutes on planks, hollowed logs or sheets of bark, the drainage being allowed to run back into the cask or other wooden container being used.

Galvanised iron or other metallic substances (except copper) must not be used throughout the process owing to the corrosive action of bluestone solutions on metals other than copper.

After draining for ten minutes the grain is dipped for three minutes in lime water, or a slaked lime suspension, made up at the rate of one half pound (½ lb.) of freshly burnt, or freshly slaked, lime, to ten gallons (10 gals.) of water. A fresh lime solution should be made up from time to time. After treating in the lime solution the seed is drained, hung up to dry and sown when convenient. **If by any chance the seed is not treated in the lime solution it must be sown as soon as dry enough to go through the drill, and in a moist seedbed.** A good way to dry the grain is to hang it up in bags, or wheat butts, on poles or straddles for a day before sowing.

2. *Dipping in Formalin Solution.*

This method is much to be preferred to the bluestone method, as it is simpler, and is also more effective in its control of barley smuts. A formalin solution is made up at the rate of one pound (1 lb.) of formalin to twenty-nine gallons (29 gals.) of water, or one pint of formalin to 40 (forty) gallons of water. The grain is dipped into this solution, which may be quite safely used in metal containers, for 3 to 5 minutes. During this period the barley should be well stirred and all rubbish or un-

broken smut masses skimmed off and burnt. After dipping, the grain should be drained and kept in the formalin-moistened bags for two hours, or be spread out on a floor or other suitable place in heaps under bags moistened with the formalin solution and left for two hours. It must then be spread out in a thin layer to dry and **sown in a moist seedbed as soon as dry enough to run through the drill.**

Unless sown as soon as possible after treating, marked reduction in the germination may result. An alternative method sometimes used is to dip in the formalin solution for one hour, then spread out the grain to dry, and sow as soon as dry enough to run through the drill.

Fig. 2.—"Covered smut" of "Pryor's" malting barley caused by *Ustilago hordei* with two average healthy heads *of the same variety for contrast*

Photo. by Govt. Printer.

3. SPRINKLING WITH FORMALIN SOLUTION.

This is the cheapest effective method yet discovered for general use, and is strongly recommended.

Details.—The seed is spread out in heaps, on a clean cement floor, wooden floor, or tarpaulin, and watered from a watering can with a solution of formalin made up at the rate of 1 pint of formalin to 40 gallons of water, or one pound (1 lb.) of formalin to 29 gallons of water. During this process the barley is shovelled about with a wide-mouthed shovel with frequent turning until every grain is thoroughly moistened. The amount of liquid required is about 1 gallon to every bushel being treated. When thoroughly moistened the heaps are covered with bags

moistened in the formalin solution, and are then left untouched for from five to six hours. The bags are then removed and the grain spread out thinly to dry. *It must be sown as soon as sufficiently dry to run through the drill, and in a moist seedbed, or considerable damage to the germinating power of the seed may result. In any case, when seed has been treated with formalin a few extra pounds of seed should be sown per acre to make up for any reduction in germination possibly brought about by the treatment. This is also desirable because of the swelling of the seed brought about by the treatment.*

This treatment gives good control of "covered smut" and brings about a reduction in the amount of "loose smut" if any is present. It is unable to ***completely*** remove "loose smut," however, as a considerable amount of the "loose smut" is carried right *inside* the grain out of reach of all ordinary fungicides, as explained near the beginning of this article.

FORMALIN-TREATED GRAIN MUST BE SOWN AS SOON AS DRY ENOUGH TO RUN THROUGH THE DRILL.

It is very important that grain treated with formalin, in any manner, be planted as soon as dry enough to run easily through the drill; and moreover that such seed should only be planted in a moist seed-bed.

The seed may be left over-night, or for 24 hours after treatment with formalin, before being sown, but further delay is very inadvisable, as if left longer than this considerable reduction in the germination power of the seed may take place.

For the same reason formalin-treated grain must be planted only in a moist seed-bed, so that germination will commence immediately after the grain is sown. This means that the treatment of the barley seed with formalin, by any method, must be delayed until sufficient rain has fallen to ensure immediate germination after planting.

4. *Hot Water Treatment.*

This is the most effective treatment for both "loose" and "covered" smuts of barley. **Where carefully carried out it completely controls both these diseases and will give crops quite free of any trace of smut, even though the seed treated was badly infected, provided always that reinfection does not take place from dirty bags, drills, etc., after treatment.** It is now being used on a large scale by the Canterbury Seed Co., N.Z., and New Zealand Breweries, Ltd., with marked success. (See N.Z. "Journal of Agriculture," Feb. 1930, pages 104-107.) It has also been strongly recommended in certain recent American publications. (See "The Control of Cereal Smuts by Seed Treatment," by F. D. Fromme, Virginia Agric. Expt. Sta. Bull. 262, June, 1928.) The treatment consists of soaking the grain in water at ordinary temperatures (60° to 86° F. is preferable) for four to five hours. It is then immersed in water at 120° F. for 1 minute and then for ten minutes in water at 127° F., or at 126° F. for 15 minutes. The temperature must not fall below 124° F. or rise above 129° F. during the process. Every effort should be made to bring all of the grain to the treating temperature at once, by keeping it well agitated. The volume of water at the last two stages should be large, in proportion to that of the amount of seed being treated, so that a big drop in temperature will not occur when the grain is added to the water.

During the treatment a little boiling water may be added with constant stirring to make up for the drop in temperature brought about by the addition of the comparatively cool grain. **After coming out of the hot water it should be immediately immersed in cold water to stop any further action. It is then spread out to dry and sown as soon as it will run freely through the drill. If dried thoroughly it may be bagged and stored for use some time later. At sowing time the rate of seeding per acre should be increased about 10 per cent. to allow for seed injured by the process.**

In this treatment no chemicals of any kind are required, the hot water alone being quite effective in killing both kinds of smut. **The method is hardly practicable**

for small barley growers, except for treating a limited number of bushels for the establishment of a "stud plot" to raise clean seed for the main crops of the following year. It is in this connection that it finds its greatest usefulness. The method is well worthy of consideration by large scale farmers desirous of raising smut-free barley seed for sale, or by such a concern as a big malting company desirous of raising the standard of the barley submitted for malting purposes. Assuming, for instance, only fifty bushels were treated the first year, this would plant 50 acres at the rate of one bushel to the acre. Should the crop from this treated seed yield only 20 bushels per acre (and it might very well give much more with good fertilising, on good land, in a good rainfall district), sufficient seed would be obtained to plant 1,000 acres the next year **without any further treatment.** In New Zealand in the season 1928-29, 4,331 acres of barley were grown in the County of Canterbury with such seed "once removed frm treatment," the results being very successful.

Fig. 3.—"Covered smut" of barley, caused by *Ustilago hordei*.
After McAlpine in "The Smuts of Australia."

DISINFECTION OF DRILLS AND HARVESTING MACHINERY.

It must be clearly borne in mind that none of the above treatments, except possibly the bluestone method, prevent *re-infection* of the barley, after treatment, from old bags, dirty drills, barley-smut-laden harvesters, etc. Before sowing it should therefore be bagged only into clean bags or bags previously dipped in formalin (1 pint to 40 gallons) and then hung up to dry, and the drills should be washed out with a strong formalin solution, made up at the rate of 1 pound of formalin to 2½ gallons of water, to kill any barley smut spores in the drill. Similarly, after using the hot water treatment, before harvesting the grain for the second

season's seed, the harvester should be thoroughly cleaned out, and washed inside, or sprayed from a hand-spraying outfit, with formalin made up at the rate of 1 pound to 2½ gallons of water. Only clean new bags, or formalin-disinfected bags, should be used to hold the grain.

ORGANIC MERCURY DUSTS.

An American organic mercury dust called "Granosan," prepared by and supplied to the writer by courtesy of Messrs. E. I. du Pont de Nemours Co., Wilmington, Delaware, U.S.A., has been used by the writer in co-operation with Messrs. K. T. Lutz and the late E. J. Limbourn of the Wheat Branch of this Department on an experimental scale at Merredin and Perth for the prevention of "covered smut" of barley with great success. It is, however, fairly dear and unobtainable commercially (so far as is known) in Australia at the present time.

"Ceresan," another organic mercury dust, which is used at the rate of 2½ ozs. per bushel of seed in a manner similar to copper carbonate for wheat, can now be obtained from Messrs. Fassett and Johnson, 36-40 Chalmers Street, Sydney, N.S.W., at about 3s. 6d. per lb. It has given very good results in the control of cereal smuts in Germany, U.S.A., and the British Isles, and is certainly very well worth while experimenting with here on a small scale alongside the standard formalin sprinkling method for the control of both barley and oat smuts, as, although relatively expensive, it lacks the many disadvantages of a wet treatment. This material has only just appeared on the West Australian market and no experiments have yet been possible locally. So far as is known to the writer this is the only organic mercury dust available locally, on a commercial scale, for the prevention of cereal smuts.

Organic mercury dusts have the advantages that they are very easily applied to the grain by the use of the same sorts of machines as are used for the "dry pickling" of wheat with copper carbonate; they can be applied at any time before the seed is sown; treated seed can be planted, if desired, in a dry seedbed without injury; and reinfection, after treatment, from dirty drills, bags, etc., is prevented.

COPPER CARBONATE.

Copper Carbonate dust is not sufficiently effective for the control of barley smuts to enable it to be used with any very great degree of success, as has been amply demonstrated in experiments carried out by this Department in the past two years. Detailed reports of these experiments will be published at a later date. In these experiments copper carbonate and "Granosan" were used at the rate of 3 ounces of dust per bushel. The formalin-sprinkling treatment, outlined above under "3," was employed for comparative purposes. "Granosan" and formalin were about equally effective and very successful, but copper carbonate only moderately so.

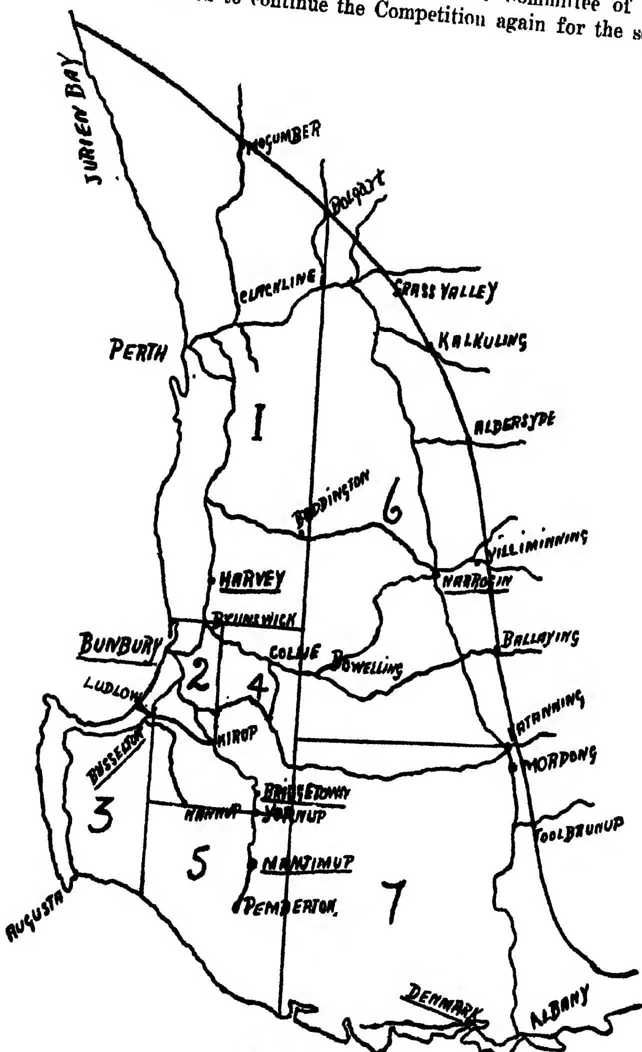
BARLEY SEED TO BE GRADED BEFORE DISINFECTION.

Before barley seed is treated with any kind of disinfectant, it should be well graded, and as much as possible of the smut masses removed.

THE BETTER DAIRYING COMPETITION.

G. K. BARON-HAY,
Superintendent of Dairying.

As the result of the extremely useful information which was obtained last year from the Better Dairying Competition, the Local Committee of the Australian Dairy Council decided to continue the Competition again for the season 1932-33.



Map and zones.

Whereas for the previous year approximately 60 entries were received, no less than 160 entries were received this year, which alone is an indication of the value and interest with which the Competition is regarded by farmers.

Cuming Smith and Mt. Lyall Farmers' Fertilisers, Ltd., have generously donated a Shield to be held by the Zone in which the four leading farms are situated, this Shield to be competed for five years and finally held by the Zone which has won it the greatest number of times.

Shield donated by Cuming Smith Mt. Lyell Farmers' Fertiliser Co.
To be held by the zone containing the four leading farmers.

No entries were received for Zone 6, embracing the great Southern District, last year, owing to the fact that the farms there are not run solely as dairy farms, and for this reason special points were allotted to this area this year with the view of encouraging the production and conservation of fodder for feeding during the lean months.

The reports for Zone 6, embracing the Great Southern District, and Zone 1, embracing the District from Perth to Brunswick, and which were judged by Agricultural Adviser H. G. Elliott, are given below.

ZONE 6.

This Zone, embracing the area from Bolgart to Mt. Barker, was judged separately from the other Zones, owing to it being in a lower rainfall area, the rainfall being 20 to 30 inches per annum.

The principal points were allotted for Silage and Summer Fodders.

The entrants in this Zone were as under:—

Messrs.—

W. G. Burges—York.
E. McManus—Northam.
L. P. James—Cranbrook.
R. McDougall—Narrogin.
T. A. Hardie & Son—Narrogin.
D. Bradford—Narrogin.
W. Chester—Mt. Barker.

The following farmers entered but later withdrew:—

Messrs.—

W. F. Weise—Narrogin.
T. N. Hogg—Narrogin.
J. Callan—Narrogin.

The prize winners were:—

First: W. G. Burges—York.
Second: E. McManus—Northam.
Third: D. Bradford—Narrogin.
Fourth: T. A. Hardie & Son—Narrogin.

The details of the points allotted are given in the table hereunder:—

——	Fodder Conserved per head.	Use of Phosphatic Licks.	Silage.	Fodder Crops.	Total Points.
	50	25	100		175
W. G. Burges ...	50	25	50	42	167
E. McManus	50	20	47	35	152
D. Bradford	50	25	35	35	145
T. A. Hardie & Son	50	20	34	35	139
L. P. James	50	...	...	85	135
W. Chester	37	20	35	41	133
R. McDougall ...	43	10	...	75	128

Where both silage and fodder crops were provided the scale of points in each instance was halved, so that the total points remained at 100.

In every case oaten and wheaten hay were not considered under conservation, as it is the practice of farmers in this zone to have ample conserved for other stock. Meadow hay was calculated under fodder conserved per head.

The first prize winner, Mr. W. G. Burges, "Tipperary," York, is to be congratulated on his fine winning entry. He has three silos which contain just over 200 tons of silage of excellent quality, the material ensiled being oats and peas and oats and vetches. The amount of wastage throughout was practically nil, and the silage was of the brown acid type relished by the milking herd.

Mr. Burges conserves a huge quantity of fodder yearly, it averaging out at about 5 tons of dry material per head of dairy stock. The principal material conserved is meadow hay, oats and peas, oats and vetches, pea hay, silage, lucerne hay, etc. The cows have sudan grass for grazing and are also fed green lucerne which is grown under irrigation.

All the competitors, with the exception of one, grow good supplies of sudan grass for grazing. This grass appears to be the best suited to the existing climatic conditions, which are too severe for most other summer green fodder crops, with the exception, perhaps, of Japanese millet, but it does not stand up to grazing as well as the sudan grass, being more easily pulled up.

The seed is planted at the rate of 4 to 8 lb. per acre on well-worked ground. The best results are obtained from land that has been fallowed and efficiently worked prior to planting. Fertiliser consisting of superphosphate is applied at the rate of 1 cwt. to 1½ cwts. per acre and drilled in with the seed to a depth of 2 to 3 inches according to the amount of soil moisture present.

Meadow hay was conserved on nearly all farms in the competition and in most cases was of good quality. The material consisted mainly of annual grasses and clovers, principally subterranean clover. The chief faults with the meadow hay conserved were:—

(a) Cutting of the material too late, the grass constituents being allowed to become too mature.

Where grasses predominate in the mixture, cutting should take place when the grasses are in the full flowering period.

(b) Allowing the material to remain for too long a period in windrows and cocks before carting—this causing a considerable amount of bleaching and loss of nutriment.

Silage was conserved on five farms, two having silos containing silage of excellent quality, being made from oats and vetches or oats and peas. The other three consisted of stack silage, none of which were of high quality, this being due mainly to the material ensiled, i.e., grasses with a little clover combined with incorrect building, stacking, and insufficiency of tonnage. The estimated loss on the stacks was excessively high, being in the vicinity of 40 per cent.

Stock Licks.—The type and kind of licks used were many and varied, and only on one farm visited was lick not being used. The principal one in use, however, was di-calcic phosphate.

Generally speaking, most of the farmers in the Competition in Zone 6 made provision for the conservation of ample fodders and green feed, the conservation per head of dairy cows being:—

1.56 acres Sudan Grass.
1.70 tons Meadow Hay.
3.30 tons Silage.
1.20 tons Hay for Chaff.

ZONE 1.

The entrants in this Zone were as under:—

Messrs.—

L. Temple—Harvey.
T. Briggs—Byford.
H. J. W. Masters—Byford.
S. F. Russell—Serpentine.
S. Bowers—Brunswick.
A. E. Clifton—Brunswick.

L. E. Shackell—Mardella.
D. Bevan—Serpentine.
L. Pearson—Benger.
A. Warburton—Brunswick.
W. Harding—Brunswick.
R. A. Clifton—Brunswick.

The first six only, however, finally submitted their farms for Judging.

The prize winners were:—

First: S. F. Russell—"Wendowie," Serpentine.
Second: T. Briggs—Byford.
Third: H. J. W. Masters—Byford.
Fourth: S. Bowers—Brunswick.

Points allotted were as in Table 1 hereunder; details are shown in Table 2.

TABLE 1.

Name.	Farm Management.	Dairy Herd.	Pasture and Fodder Crops.	Fodder Conservation.	Utilisation of Skim. Milk.	Butter Fat Production per acre.	Total Points.
	75	100	100	150	25	50	500
S. F. Russell	72	92	93	140	*25	50	472
T. Briggs	50	91	75	130	*20	18	384
H. J. W. Masters ...	59	73	71	125	*13	38	379
S. Bowers	40	85	59	120	*23	44	371
L. Temple	52	92	74	81	24	46	369
A. E. Clifton	37	70	59	107	*24	21	318

* Whole Milk Suppliers.

The first prize winner in this Zone, Mr. S. F. Russell, lives on his property, "Wendowie," adjoining the township of Serpentine.

This property, which has an excellent frontage along the Serpentine River, is one of 134 acres, 115 of which are used for dairying, the remainder being efficiently utilised for an orchard, mainly citrus.

The dairying portion, 115 acres, is extremely well subdivided into 24 paddocks, averaging about 4¾ acres each. Of this area 9½ acres are irrigated and utilised as follows: 3¾ acres of elephant grass which gives on an average 23 tons of green feed per acre cutting. Two and a half acres are sown with maize giving an average yield of 33 tons of green feed per acre. One acre devoted to the growing of cowpeas which are cut three times during the growing season for feeding along with elephant grass and maize. Cowpeas are very high yielders of green feed rich in protein and, fed in conjunction with maize and elephant grass, make a fairly even balanced ration for cows. The balance of the irrigated area, 2¼ acres, is sown down to permanent pasture consisting of paspalum, perennial rye grass and white clover, which is used principally as a night paddock for the dairy cows.

The meadow hay was made from the annual pastures, which consist principally of subterranean clover, rye grass, and other annual grasses and clovers.

The dairy herd is composed of 41 Aryshire and grade Ayrshire cows. Of the 31 cows at present milking, 21 are heifers. The dairy type is good and the condition of all cows excellent. In addition to the milch cows Mr. Russell carries 17 head of young stock over nine months old, five calves, and one bull.

The dairy sire is a pure-bred Ayshire bull "Purity Director of Wendowie," the sire of this bull being "Director of Gowrie Park," and the dam "Purity of Gowrie Park." This cow gave 404 lb. butter fat and 8,041 lb. milk as a junior two-year-old. The bull is of good type and constitution and was Reserve Champion in 1931 and winner of its class in 1932 at the Perth Royal Show.

Mr. Russell's property produced 53.1 lb. of butter fat per acre during 1932. All milk is sold on a whole-milk basis, and the pigs and calves are fed on whey obtained from the Serpentine Cheese Factory. Concentrates are added to the whey so as to make up for its deficiencies as a calf and pig food.

The pigs on the property at the time of judging were four porkers and one Berkshire-Tamworth sow. All were well housed and in a clean and good condition.

Buildings.—All buildings are strongly constructed, and under the one roof is the milking shed, separator room, engine room, mixing shed, and hay shed. A milking machine is used and kept in perfect condition. The whole floor space is efficiently utilised, and the engine when in operation during milking can be utilised also for crushing oats, etc., or chaff cutting. Electric light is installed in buildings and house, power being obtained from the engine during milking.

Pastures.—The property is well divided with central races. All paddocks are top-dressed annually—half with superphosphate and sulphate of ammonia, and the balance with superphosphate only. The bulk of the pasture consists of subterranean clover and annual rye grasses. Along the river flats paspalum, couch, and clovers flourish. Mr. Russell adopts the system of rotational grazing, and in all paddocks the stock have access to water. Renovation of the pastures is carried out by the use of a skim disc in the autumn, followed periodically by chain harrows for distributing the animal droppings.

Irrigation is carried out for the orchard, etc., by the use of an engine and pump which delivers over a quarter million gallons in 10 hours. From this system water is laid on to the house, garden, milking shed, and dairy.

GENERAL.

Pastures.—The bulk of the pastures judged in Zone 1 were of the annual winter and spring type consisting of Subterranean clover, Cluster clover, ***Bromus sp.***, Rye grass, and other annual grasses and clovers. The undesirable barley grass (***Hordeum murinum***) occurs most on the older, non-renovated pastures, and in some instances it constituted the bulk of the pasturage. It is pleasing to note, however, the ever-increasing stand that the annual types of rye grass, such as Wimmera Rye grass, are making. The average number of acres to one cow is 3.86, or 2 acres to every head of dairy stock kept.

Top-dressing with superphosphate and, in some cases, with superphosphate and ammonia is carried out on all competitors' farms. Some of the farmers apply an autumn and spring dressing, while others only top-dress annually. Renovation of the pastures by means of harrows and ploughing is carried out fairly extensively. The results show that, where mixed, well-fertilised and rotationally-grazed pastures occur, the highest return for butter fat per acre are obtained.

Silage.—All the silage judged, with the exception of that on one farm, was in stacks, and in all cases the silage was of the dark, sweet type, made principally from grass and suberranean clover pasture. All stacks were well built, and the percentage wastage generally was low. The amount of silage conserved per head of dairy cows in this Zone worked out at 0.81 tons.

Meadow Hay.—Generally speaking, the hay in this Zone was of good quality, but in some cases cutting was a little on the late side, consequently some of the grasses were too mature to make ideal hay, 0.75 tons of hay being conserved per head of dairy stock.

Dairy Herds.—On the whole the herds were found to be in excellent condition, and on all farms uniformity in type was a distinct feature. Pure-bred bulls are in use on all the farms, and in the majority of cases the bulls were from high-producing cows.

Pigs.—Throughout this Zone the number of pigs kept equal one pig to four cows, the smallness in the number of pigs being due to the fact that nearly all of the competitors were in the whole-milk trade. The principal type of pigs kept were Berkshire and Tamworth, and Berkshire-Tamworth cross.

Stock Shelter.—Shade in the paddocks from trees in some cases was not sufficient. Farmers should realise that protection and comfort for their dairy herds is as equally important as food and water, and that the maximum production cannot be obtained unless all these are in abundance.

—	Max. Points.	S. F. Russell.	T. Briggs.	H. J. W. Masters	S. Bowers.	I. Temple.	A. E. Clifton.
1. FARM MANAGEMENT—(75 points):							
(a) Lay-out and Convenience ...	30	29	19	24	15	22	18
(b) General Management, including Sanitation, etc.	25	23	16	19	16	21	14
(c) Book-keeping and Records ...	20	20	15	16	9	9	5
2. DAIRY HERD—(100 points):							
(a) Breeding—System of	25	23	23	20	21	22	18
(b) Dairy Type and Condition ...	30	26	26	23	26	25	20
(c) Bull (give particulars of breeding and production ancestry) ...	25	25	25	20	20	25	18
(d) Pigs—breed, condition, etc. ...	20	18	17	*10	18	20	14
3. PASTURE AND FODDER CROPS -100 points):							
(a) Pasture	60	†85	37	†71	37	†74	†59
(b) Fodder Crops	40	†71	38	...	22	†69	...
4. FODDER CONSERVATION—(150 points):							
(a) Silage—							
1. Succulency	20	...	20	18	20	...	18
2. Mixture	20	...	17	17	18	...	17
3. Type of Silage	10	...	9	8	8	...	8
4. Percentage Waste	20	...	16	17	17	...	14
(b) Hay—							
1. Mixture	20	19	16	18	18	...	18
2. Condition	20	19	13	18	18	...	10
(c) Amount of Fodder conserved per head	20	20	14	13	8	7	7
(d) General Lay-out for convenience in feeding	20	19	15	16	13	15	15
5. UTILISATION OF SEPARATED MILK FOR PIGS, POULTRY, ETC—(25 points):							
(a) Pigs	20	*20	*16	*10	*19	20	*20
(b) Poultry	5	5	4	3	4	4	4
6. BUTTER FAT PRODUCTION (per acre) ...	50	50	18	38	44	46	21
Acres devoted to Dairy Farming ...	...	115	300	90	110	89	200
	500	472	384	379	371	360	318

* Partly or wholly on the whole milk trade. † Calculated on a *pro rata* basis.

HORTICULTURAL NOTES.

(G. W. WICKENS, Superintendent of Horticulture.)

When this number of the "Journal" is issued in March, fruit export, both of the dried and fresh product, will be in full swing, and cables will be awaited by growers and shippers anxious to learn how the fruit arrived on the market and what prices were realised. Had the season continued in the new year in the favourable manner experienced in the last months of the old, much more satisfactory export conditions would have obtained, but the extreme heat in February caused considerable damage to fruit crops and has certainly lessened the quantity available for export. Amongst the apples, Jonathans were the worst affected, for not only were many fruits scorched brown on the trees, but a phenomenal shedding took place, 50 per cent. to 75 per cent. of the crop in some orchards falling. As Jonathans were bearing heavily this season, the loss to growers is a severe one. Cleopatras, Granny Smith, and Dunns scorched rather badly in orchards where the trees were heavily laden, but there was no abnormal shedding of these varieties.

Vineyards also suffered severely, and though currants and sultanas were too advanced to be greatly harmed, muscats were badly affected and a large proportion of the crop was ruined, while export varieties also sustained damage.

I have not mentioned the above results of the heat wave just for the purpose of telling a doleful tale, but I want to impress upon growers and packers that it is no use sending heat damaged fruit to the ports and expecting to receive a permit for it. The need for supplying the overseas markets with fruit of good quality and appearance was never more urgent than now, when competition with other countries is so severe, and sunburned fruit lacks both quality and appearance and *must* be thrown into the discard. Already a number of cases of grapes, sent forward for one of the early boats, have been rejected on account of wilted berries, and the same will happen if sunburned apples or pears arrive.

I shall also take this opportunity of issuing a further warning in regard to San Jose infested fruit; although the pest named is not a very difficult one to control and does not do as much damage to fruit and trees in this State as red mite—Bryobia—the fact remains that other countries in the world where it is not present, are taking the most drastic steps to prevent its introduction, and if infested fruit is found at the port of entry, not only will it be refused admission, but quite possibly prohibition of all future consignments will be enforced against the country of origin. Because of this, no fruit found to be infested with San Jose scale will be passed for shipment, and, if the infestation is at all severe, the whole line will be rejected.

Fruit growers in all districts will have noticed this season a marked increase in the number of trees with leaves affected by chlorosis, and they will be pleased to know the Department has arranged to conduct experiments in an endeavour to find a treatment to control the trouble.

Growers of stone fruits have had more than their share of misfortune this season. Not only has fruit fly been more in evidence than last year, but Rutherglen bug appeared in plague form and took heavy toll of the crop. When it comes in millions, as it did this season, it is nearly impossible to suggest any successful method of control. Fortunately, however, these visitations are rare, for though the insect is always here, the damage done to fruit is usually negligible. Fruit fly is not in the same category, for effective measures of control are well known and though baiting, trapping and destruction of all infested fruits entails a lot of labour, the results are worth the effort.

Three pleasing facts can be chronicled to counterbalance some of the reverse sort set out above—the State still remains free from Codlin Moth, Apple Scab, and Phylloxera.

FIELD EXPERIMENTS WITH WHEAT, 1932.

DAMPAWAH EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
F. GISHUBL, Farm Manager.

The farm is situated 30 miles east of Perenjori, having been formerly a portion of Karara Station on the fringe of the lower Murchison.

The soil is a red friable loam, uniform in appearance, and was originally timbered with York gum, giant mallee, karara and mulga scrub.

The land was cleared in 1927 and early 1928, and fallowed the same year. It was cropped in 1929, and in 1930 the stubble was utilised for grazing. During July and August, 1931, the land was ploughed, under favourable conditions, to a depth of from 3in. to 4in. with a disc cultivating plough. During late August and early September, it was cultivated with a springtyne implement. Seeding was carried out with a combined cultivator drill.

The following table shows the rainfall registered at the farm since its establishment:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for Year.
1928 ...	*	*	*	*	164	91	238	142	71	34	743	6	156	*
1929 ..	17	220	64	...	267	234	60	62	18	33	674	120	...	1,095
1930 ...	...	...	93	123	48	404	160	93	22	41	768	31	54	1,069
1931 ...	...	12	3	25	237	113	232	95	131	40	848	179	120	1 187
1932 ...	49	..	56	46	138	91	205	302	59	125	920	6	79	1,156

* No records.

This year the rainfall for the growing period was the highest recorded since the establishment of the farm. Despite this, however, growing conditions were not ideal, particularly for the early and mid-season varieties. No satisfactory falls were received until the 28th May and, in consequence, germination was delayed until early in June. During the latter month, which was comparatively dry, several severe frosts were experienced. Both these factors further retarded the growth of the crop.

Conditions were excellent throughout July and August, but during September only 59 points of rain was registered in three falls. In addition, two severe frosts adversely affected the crops, particularly the early varieties. The very early maturing variety, Noongaar, was the least affected. The mid-season maturing varieties received some benefit from the October rains, which this year were considerably above the average.

Time of Seeding Experiment.

The object of this experiment is to determine the most suitable month to plant the wheat crop.

In previous years the varieties used were the mid-season variety Nabawa, planted in April, May and June, and the early maturing variety Gluyas Early, planted in May, June and July. As it has been found that mid-season varieties are too late for this district, the experiment was re-arranged this year. Gluyas Early is now planted in April, May and June, and the very early maturing variety Noongaar in May, June and July.

The results obtained are tabulated below:—

TIME OF SEEDING EXPERIMENT.

Variety—Gluyas Early. 22 % Superphosphate—90lbs. per acre. Seed—45lbs. per acre.

Planted.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%
20th April	14 0	13 52	14 0	13 20	13 28	13 44	95
20th May	13 36	14 40	14 16	14 24	15 12	14 26	100
20th June	8 8	8 0	6 48	8 8	6 40	7 33	52

TIME OF SEEDING EXPERIMENT.

Variety - Noongaar. 22 % Superphosphate— 90lbs. per acre. Seed—45lbs. per acre.

Planted.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%
20th June	16 32	17 4	17 4	15 44	15 4	16 18	81
20th May	21 28	20 24	20 56	18 40	19 28	20 11	100
20th July	1 52	1 36	2 8	1 52	2 0	1 54	9

Although the results with these two varieties are for one year only, they confirm the findings at other experiment farms in the areas of lighter rainfall, viz., that it is unwise to extend the seeding period beyond the end of May, even when a very early maturing variety is used.

Rate of Seeding Experiment.

The object of this experiment is to ascertain the most economical rate at which to plant the wheat crop with—

(a) A mid-season free-stooling variety;

(b) An early sparse-stooling variety.

To meet these requirements, the variety Nabawa was used in the first case, and the variety Noongaar in the second.

RATE OF SEEDING EXPERIMENT.

Planted on 20th April, 1932. Variety—Nabawa. 22 % Superphosphate—90lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1929–32.	Percentage Yields, 1929–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
30lb.	11 52	11 44	11 12	10 24	11 52	11 25	98	10 48	106
45lb.	12 0	11 44	10 56	11 28	11 52	11 36	100	10 13	100
60lb.	11 52	11 28	11 20	12 16	10 40	11 31	99	9 41	95

RATE OF SEEDING EXPERIMENT.

Planted on 19th May, 1932. Variety—Noongaar. 20 % Superphosphate—90lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1929–32*	Percentage Yields, 1929–32*
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
30lb.	21 20	22 32	20 32	20 16	20 56	21 7	97	14 31	100
45lb.	22 0	22 48	20 56	20 40	22 24	21 45	100	14 31	100
60lb.	22 16	23 44	21 4	21 44	21 44	22 6	102	14 19	99

* Excluding 1930.

The results again indicate that little or no advantage is obtained by sowing at a rate in excess of 30 lbs. per acre.

Rate of Application of Superphosphate Experiment.

This experiment is divided into two sections in order to test the effects of applying the following amounts of superphosphate per acre with the wheat crop:

Section 1—No super.
150 lbs. per acre (control).
75 lbs. per acre.

Section 2—225 lbs. per acre.
150 lbs. per acre (control).
300 lbs. per acre.

The results obtained are tabulated below:—

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Planted on 4th May, 1932. Variety—Gluyas Early. Seed—45lbs. per acre.

Rate of Application of 22 % Superphosphate per Acre.	Computed Yields per Acre. Sec 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1929–32*	Percentage Yields, 1929–32*
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
225lb.	18 0	18 40	17 20	17 44	17 4	17 46	101	15 55	99
150lb.	18 32	16 40	16 40	17 28	18 40	17 36	100	16 4	100
300lb.	19 44	18 0	18 24	18 8	18 24	18 32	105	16 23	102

* Excluding 1930.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Planted on 4th May, 1932. Variety—Gluyas Early. Seed—45lbs. per acre.

Rate of application of 22 % Superphosphate per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre 1932.	Percentage Yields, 1932.	Average Yields per acre, 1929–32*	Percentage Yields, 1929–32*
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
No Superphosphate ...	6 32	6 32	6 16	7 44	6 24	6 42	37	6 44	41
150lb.	18 40	18 8	18 16	18 8	18 8	18 16	100	16 32	100
75lb.	16 56	16 16	17 12	16 8	16 8	16 32	90	15 14	92

* Excluding 1930.

The results confirm those of previous years and also those obtained at other experiment farms in indicating that no advantage is derived from applying superphosphate at rates in excess of 150 lbs. per acre. With wheat at its present price the optimum quantity to apply would appear to be somewhat above 75 lbs. per acre and would probably be from 90 to 100 lbs.

Seasonal Planting Experiment.

The objects of this experiment are—

(a) To ascertain the most suitable month to plant the late, mid-season, early and very early maturing varieties of wheat;

(b) To determine the most prolific of each of the above types.

To meet the requirements of the experiment, three sections were planted, viz.:

(a) Section 1, planted in April, representing early planting;

(b) Section 2, planted in May, representing mid-season planting;

(c) Section 3, planted in June, representing late planting.

Each section, planted in its respective month, was repeated five times, all plots being eventually harvested for grain. The standard early variety, Gluyas Early, was planted in the control plots in all sections.

SEASONAL PLANTING EXPERIMENT.

APRIL PLANTING.

Planted on 18th April, 1932. 22 % Superphosphate, 90lbs. per acre. Seed—45lb. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Percentage Yields, 1931–32.
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Bencubbin ...	Midseason ...	12 8	12 32	12 0	11 4	11 12	11 47	89	92
Gluyas Early ...	Early ...	14 24	12 24	12 16	12 48	13 52	13 9	100	100
Totadgin ...	Early ...	14 16	12 48	13 12	12 16	13 20	13 10	100	...
Nabawa ...	Midseason ...	10 48	10 0	8 56	10 32	10 48	10 13	78	77
Gluyas Early ...	Early ...	14 0	12 24	12 32	13 20	13 44	13 12	100	100
Merredin ...	Early ...	14 16	14 40	12 48	13 20	14 32	13 55	105	94
Carrabin ...	Early ...	13 36	12 8	11 36	12 40	13 36	12 43	95	95
Gluyas Early ...	Early ...	14 8	12 48	12 48	13 12	14 0	13 25	100	100
Noongaar ...	Very Early	17 4	14 48	14 32	14 48	16 8	15 28	116	111

SEASONAL PLANTING EXPERIMENT.

MAY PLANTING.

Planted 16th May, 1932. 22 % Superphosphate—90lb. per acre. Seed—45lb. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Percentage Yields, 1931–32.
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Geeralying ...	Early ...	11 36	11 4	11 52	12 32	10 56	11 36	82	69
Gluyas Early ...	Early ...	15 12	12 56	15 12	14 24	13 12	14 11	100	100
S.H.J.	Early ...	12 32	10 8	11 52	13 12	11 20	11 49	83	66
Bencubbin ...	Midseason ...	12 40	9 4	13 36	12 24	11 28	11 50	88	101
Gluyas Early ...	Early ...	14 24	11 36	14 8	14 56	12 0	13 25	100	100
Nabawa ...	Midseason ...	11 4	8 48	11 52	12 32	9 20	10 43	80	75
Carrabin ...	Early ...	15 4	12 0	15 28	15 36	12 24	14 6	99	88
Gluyas Early ...	Early ...	14 48	12 16	16 40	14 32	12 48	14 13	100	100
Totadgin ...	Early ...	13 28	12 0	16 16	13 36	11 44	13 25	94	...
Merredin ...	Early ...	14 56	11 52	18 40	15 12	13 36	14 51	105	89
Gluyas Early ...	Early ...	14 32	12 16	17 12	13 52	13 4	14 11	100	100
Noongaar ...	Very Early ...	16 8	15 28	19 52	18 16	16 32	17 15	122	91

SEASONAL PLANTING EXPERIMENT.

JUNE PLANTING.

Planted on 15th June, 1932. 22 % Superphosphate—90lb. per acre. Seed - 45lb. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.	Sec. 2	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Percentage Yields, 1931-32.
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Geeralying ...	Early ...	9 44	9 44	12 16	12 48	12 16	11 22	88	94
Gluyas Early ...	Early ...	10 16	10 8	15 28	15 12	13 52	12 59	100	100
S.H.J.	Early ...	9 44	10 24	13 44	13 20	12 24	11 55	93	97
Merredin ...	Early ...	6 16	8 56	13 28	12 32	11 28	10 32	78	88
Gluyas Early ...	Early ...	9 12	12 40	15 52	14 56	14 40	13 28	100	100
Noongaar ...	Very Early...	12 24	14 32	17 28	15 44	15 52	15 12	113	117

The results again indicate that for this district, the early and very early maturing varieties are the most prolific.

Potash-Nitrogen Experiment.

The object of the experiment is to ascertain the effect upon the yield of the wheat crop from the application of—

(a) a nitrogenous fertiliser;

(b) a nitrogenous + a potassic fertiliser

when used in conjunction with superphosphate. Sulphate of ammonia and muriate of potash were used and were applied shortly before seeding.

The results obtained are given below:—

POTASH NITROGEN EXPERIMENT.

Planted on 20th May, 1932. Variety—Gluyas Early. Seed—45lb. per acre.

Rate of Application of Fertiliser per acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%
112lb. Sulphate of Ammonia; 112lb. Superphosphate	18 24	18 32	19 20	19 20	19 20	18 59	101
2lb. Superphosphate	18 40	18 32	18 40	18 56	18 32	18 40	100
112lb. Sulphate of Ammonia; 112lb. 11 Superphosphate; 56lb. Muriate of Potash	19 20	20 8	20 8	19 28	19 20	19 41	106

These results which are for one year only, and hence cannot be taken as conclusive, show that the addition of sulphate of ammonia gave practically no result, while there was only a slight response when both sulphate of ammonia and muriate of potash were added. This increase, however, is insufficient to cover the cost of the fertiliser.

FIELD EXPERIMENTS WITH WHEAT, 1932.

CHAPMAN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
F. L. SHIER, Farm Manager.

The following table shows the monthly rainfalls, as recorded at the farm, during 1932, together with the averages over the past 27 years:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for Year.
1932 ...	118	Nil	61	118	356	182	366	556	112	144	1,716	3	33	2,044
Av. 27 yrs.	28	44	62	47	247	421	401	275	162	97	1,603	31	26	1,841

The season promised to open well with early April rains which germinated weed seeds and enabled the fallowed land to be cultivated. Following these rains, however, a dry period, lasting until towards the end of May occurred. Strong drying winds were also experienced. Ideal seeding conditions thus prevailed until planting operations were completed on the 20th June. During this period, further cultivations were necessary to check weed growth on the fallow.

Heavy rains were experienced during July and August, the registrations for the latter month being particularly high. Satisfactory finishing rains fell during October.

The land on which the experiments were conducted, originally carried jam and wattle timber and had been cleared for many years.

It was ploughed to a depth of four inches with a mouldboard plough during July of the previous year. This was followed by a springtyne cultivation in September, again in April after rain, and again immediately prior to planting.

The plots which were planted in June and July received additional cultivations to assist in controlling weed growth.

Time of Seeding Experiment.

This experiment was commenced in 1923, and since then has been planted each year with the early maturing variety Gluyas Early. Owing, however, to the plots being destroyed by fire in 1924 and other factors interfering with the experiment in 1925 and 1926, the results were not obtained for these three years.

Commencing in 1928, the midseason variety, Nabawa, was included in the experiment.

Each variety was planted as a separate experiment, the Gluyas Early being planted in mid-May, June and July, and the Nabawa in mid-April, May, and June. The results are given below:—

TIME OF SEEDING EXPERIMENT.

Variety—Nabawa. 22 % Superphosphate—112 lbs. per acre. Seed—60lbs. per acre.

Planted.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre. 1932.	Percentage Yields, 1932.	Average Yields per acre. 1928–32.	Percentage Yields. 1928–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
April 24th	15 44	14 40	17 12	17 52	18 32	16 48	154	10 31	91
May 20th	10 0	10 32	11 20	11 20	11 20	10 54	100	11 32	100
June 17th	10 32	11 20	11 44	13 12	12 48	11 55	109	10 59	95

TIME OF SEEDING EXPERIMENT.

Variety—Gluyas Early. 22 % Superphosphate—112lbs. per acre. Seed—60lbs. per acre.

Planted.	Computed Yields per Acre.					Average Yields per acre, 1932.	Per-centage Yields, 1932.	Average Yields per acre, 1926-32.	Per-centage Yields, 1926-32.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	...	bus. lb.	%
June 17th	9 4	11 28	12 48	10 56	12 48	11 25	112	12 30	84
May 20th	6 48	9 20	10 40	11 44	12 56	10 17	100	14 52	100
July 15th	7 12	7 4	6 56	6 40	8 24	7 15	70	7 47	52

This year's results are in favour of the April planting rather than the May planting. The June planting results for both the early and the mid-season varieties are also higher than the May planting results. The July planting with the early maturing variety, Gluyas Early, is shown to be decidedly unsatisfactory, this month being too late for wheat planting.

The unusually dry conditions early in May had placed the May planted plots at a disadvantage as against the plots planted in April and also those planted in June.

However, the average results over a number of years show that better yields can be expected when the wheat crop is planted during the month of May.

Rate of Application of Superphosphate Experiment.

The object of this experiment is to ascertain the most profitable rate of superphosphate to apply to the wheat crop.

To meet the requirements, the experiment was designed so that the three-plot system could be maintained. It was, therefore, divided into two sections, viz.:—

Section 1—consisting of three plots which received respectively 300 lb., 150 lb., and 225 lb. per acre;

Section 2—consisting of three plots which received respectively no superphosphate, 150 lb., and 75 lb. of superphosphate.

In each section, the rate of 150 lb. of superphospate was regarded as the control. The results obtained are shown hereunder:—

RATE OF SUPERPHOSPHATE EXPERIMENT.

Planted on 21st May, 1932. Variety—Nabawa. Seed—60lbs. per acre.

Rate of Application of 22 % Superphosphate.	Computed Yields per Acre.					Average Yields per acre, 1932.	Per centage Yields, 1932.	Average Yields per acre, 1929-32.	Per-centage Yields, 1929-32.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	...	bus. lb.	%
300 lb.	15 20	12 24	10 40	10 32	11 28	12 5	113	14 38	106
150 lb.	12 48	13 12	10 16	8 24	8 48	10 42	100	13 46	100
225 lb.	11 4	11 36	10 8	9 4	9 4	10 11	95	14 20	104

RATE OF SUPERPHOSPHATE EXPERIMENT.

Planted on 21st May, 1932. Variety—Nabawa. Seed—60lbs. per acre.

Rate of Application of 22 per cent. Superphosphate per Acre.	Computed Yields per Acre.					Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1929–32.	Percentage Yields, 1929–32.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Nil	6 32	6 32	7 12	7 28	7 4	6 58	63	10 27	75
150 lb.	10 48	10 40	11 12	10 56	11 28	11 1	100	13 55	100
75 lb.	8 16	9 4	10 8	9 36	9 44	9 22	85	12 30	90

The plot receiving no superphosphate would benefit from the residual superphosphate applied in previous years. As the experiment will be planted on the same land each year, this residual effect will gradually disappear.

However, this year's experiment and the average results over four years indicate that the rate of superphosphate could be increased with advantage above 75 lb. per acre.

Although the applications of higher rates of superphosphate give increased yields, the most economical rate under present economic conditions would probably be about 112 lb. per acre.

Seasonal Planting Experiment.

The objects of this experiment are:—

1. To ascertain the most suitable month to plant the late, mid season, early, and very early maturing varieties of wheat; and

2. To determine the most prolific of each of the above types.

To meet the requirements of the experiment, three sections were needed, viz.:—

(a) Section 1, planted in April—representing early planting;
(b) Section 2, planted in May—representing mid-season planting;
(c) Section 3, planted in June—representing late planting.

In all sections the mid-season maturing variety, Nabawa, was planted in the control plots. The results are given below:—

SEASONAL PLANTING EXPERIMENT—APRIL PLANTING.

Planted on 21st April. 22 % Superphosphate—112lb. per acre. Seed—60lb. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre. 1932.	Percentage Yields, 1932.	Percentage Yields, 1928–32.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Yandilla King	Late	12 48	14 56	12 56	10 48	10 16	12 21	95	84
Nabawa ...	Midseason ...	14 16	13 44	12 48	12 24	12 8	13 4	100	100
Sutton ...	Late	17 44	16 56	18 56	14 56	14 8	16 32	126	†114
Baroota Wonder Early	Midseason ...	20 24	19 20	19 20	16 0	17 20	18 29	140	*115
Nabawa ...	Midseason ...	13 20	14 16	13 52	12 16	12 24	13 13	100	100
Bencubbin ...	Midseason ...	22 32	24 56	22 16	19 4	16 40	21 5	160	†151

* 1928–29 and 1932. † 1930–32.

SEASONAL PLANTING EXPERIMENT—MAY PLANTING.

Planted on 18th May, 1932. 22 % Superphosphate—112lb. per acre. Seed—60lb. per acre.

Variety.	Maturity.	Computed Yields per Acre.										Average Yields per acre, 1932.		Percentage Yields, 1932.	Percentage Yields, 1928-32.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	%
Noongaar ...	Very Early ..	10	56	12	56	10	0	10	24	10	40	10	59	108	82
Nabawa ...	Midseason ...	12	0	10	32	8	32	9	4	10	40	10	10	100	100
Yandilla King	Late	10	40	9	12	6	16	8	0	8	32	8	32	84	92
Sutton ..	Late	15	4	12	32	8	48	11	36	13	4	12	13	122	†114
Nabawa ...	Midseason ...	12	32	10	40	8	0	8	32	10	24	10	2	100	100
Baroota Wonder Early	Midseason ...	14	40	12	32	9	36	12	8	12	56	12	22	124	*103
Bencubbin ...	Midseason ...	14	40	10	24	9	4	12	0	12	40	11	46	117	†118
Nabawa ...	Midseason ...	12	56	8	0	8	16	9	52	10	56	10	0	100	100
Geeralying ...	Early ...	15	28	10	0	10	40	11	28	11	28	11	49	118	99
Totadgin ...	Early ...	17	20	10	40	10	24	12	24	12	16	12	37	128	...
Nabawa ...	Midseason ...	12	8	8	0	8	32	10	16	10	24	9	52	100	100
Comeback ...	Early ..	12	8	8	56	8	40	9	52	9	52	9	54	100	‡87
Carrabin ...	Early ...	13	20	10	40	9	44	10	0	9	12	10	35	103	97
Nabawa ...	Midseason ..	12	56	8	0	8	56	10	40	11	4	10	19	100	100
S.H.J.	Early ...	11	20	9	44	8	8	9	12	8	32	9	23	91	100
Merredin ...	Early ..	13	4	8	16	8	0	9	20	9	28	9	38	92	100
Nabawa ...	Midseason ...	13	52	7	52	9	4	11	4	10	32	10	28	100	100
Gluyas Early	Early ...	15	20	7	52	9	36	11	20	10	32	10	56	104	99

* 1928–29 and 1932 † 1930–32. ‡1929–32

SEASONAL PLANTING EXPERIMENT—JUNE PLANTING

Planted on 17th June, 1932. 22 % Superphosphate 112 lb per acre Seed—60lb per acre.

Variety	Maturity.	Computed Yields per Acre.										Average Yields per acre, 1932		Percentage Yields, 1932	Percentage Yields, 1928-32.
		Sec. 1.		Sec. 2.		Sec 3.		Sec. 4		Sec. 5					
		bus.	lb	bus.	lb.	bus.	lb.	bus.	lb.	bus	lb.	bus.	lb.	%	%
Noongaar ...	Very Early ...	11	28	14	16	15	4	13	28	20	0	14	49	86	81
Nabawa ..	Midseason ..	12	32	16	32	17	28	17	28	22	48	17	22	100	100
Sutton ...	Late	11	20	15	28	17	28	18	0	23	44	17	12	99	
Bencubbin ...	Midseason ..	11	52	14	16	18	40	18	8	23	12	17	14	94	†104
Nabawa ...	Midseason ...	12	0	16	24	19	44	20	0	23	36	18	24	100	100
Geeralying .	Early .	12	16	14	40	16	48	18	32	22	8	16	53	92	89
Totadgin ..	Early ..	14	32	15	4	10	56	11	28	16	48	13	46	68	
Nabawa ...	Midseason ...	17	20	17	44	19	20	19	4	27	28	20	11	100	100
Comeback .	Early .	14	56	13	36	12	56	13	44	21	36	15	22	76	†76
Carrabin ..	Early ...	17	44	14	0	18	0	18	24	27	12	19	4	93	†89
Nabawa ...	Midseason ..	17	44	16	56	20	40	20	0	27	4	20	29	100	100
S.H.J. ..	Early ..	16	48	15	20	18	24	16	56	26	32	18	48	92	91
Merredin ...	Early ...	17	28	14	56	18	24	17	36	27	28	19	10	92	90
Nabawa ...	Midseason ..	18	32	20	16	19	44	17	28	28	24	20	53	100	100
Gluyas Early...	Early ..	14	56	16	40	14	56	16	48	23	12	17	18	83	89

† 1930-32.

This year's results and the average results for previous years show that, with the exception of Yandilla King, all varieties planted in April show to advantage over the control variety, Nabawa, the variety Bencubbin being outstanding.

In the May planting, the results show that, with three exceptions, all varieties equalled or exceeded the yields of the control. In this section the new early maturing variety, Totadgin, has shown to advantage, but as this is the first year it has been included no definite conclusions can be drawn.

The results for this year again demonstrate the suitability of Sutton and Bencubbin for this and other districts having similar climatic conditions.

In the June planted section, contrary to what might have been expected, the yield of the control was not exceeded by the earlier maturing varieties, but was almost equalled by a late maturing variety. The actual yields obtained from the different varieties are greater than those from either the April or May plantings.

This may be accounted for by the excellent rains which fell throughout the growing period and particularly during the maturing period. These rains may also account for the mid-season and late varieties comparing more than favourably with the earlier maturing varieties in the late planted (June) section.

Potash-Nitrogen Experiment.

The object of this experiment is to determine the effect upon the wheat crop of the application of—

(a) A nitrogenous fertiliser;

(b) A nitrogenous + a potassic fertiliser.

Sulphate of ammonia, a nitrogenous fertiliser, and muriate of potash, a potassic fertiliser, were used and were applied to the respective plots separately, a few days prior to seeding. The results obtained are given below:—

POTASH NITROGEN EXPERIMENT.

Planted on 20th May, 1932. Variety—Nabawa. 22 % Superphosphate—112lbs. per acre.

Seed—60lbs. per acre.

Rate of Application of Fertiliser per acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Per centage Yields 1932.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	...
112lb. Sulphate of Ammonia, 112lb. Superphosphate	9 4	9 4	9 36	10 16	10 56	9 47	107
112lb. Superphosphate	8 32	8 24	8 0	10 32	10 8	9 7	100
112lb. Sulphate of Ammonia, 56lb. Muriate of Potash, 112lb. Superphosphate ...	9 20	9 28	9 28	10 56	11 52	10 13	112

These results, being for one year only, cannot be taken as conclusive. However, they indicate that a small increase in yield can be expected when a nitrogenous fertiliser is applied, and also a slightly larger increase when both a nitrogenous and a potassic fertiliser are applied in addition to superphosphate. These increased yields, however, would not cover the increased cost of the special fertilisers.

FIELD EXPERIMENTS WITH WHEAT AND OATS, 1932.

MERREDIN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
J. H. LANGFIELD, Farm Manager.

The total rainfall for the year was 1,307 points, of which 1,113 points fell during the growing period (May to October). The following table shows the monthly rainfall for the year, together with the average over a period of 21 years:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for Year.
1932 ...	51	11	59	42	160	69	231	283	56	314	1,113	...	31	1,307
Av. 21 yrs.	52	54	116	82	136	185	190	152	90	85	838	43	52	1,237

Very little rain fell before 25th May, and consequently it was not possible to work the fallow wet before seeding and control weed growth. June was a comparatively dry month, only 69 points being recorded, but the registrations for both July and August were above the average. During September the rainfalls were scanty, only 56 points being recorded. The October rainfalls were unusually high, 314 points being recorded against the average for this month of 85 points.

The October rains, by reason of their lateness, lost much of their value, except for the late plantings. As a result of these late rains, however, an excellent sample of plump grain was obtained.

The land on which these experiments were conducted originally carried Salmon Gum and Gimlet timber, the soil being typical of such country. For some years the three-year rotation, namely, fallow, crops (chiefly wheat) and pasture, has been practised.

During June, 1931, the land had been ploughed to a depth of 4 inches with a heavy disc plough. It was worked with a disc cultivating plough during September and again just before seeding. Plots which were planted during June and July also received further cultivations after the May rains.

Time of Seeding Experiment.

This experiment has been conducted for the past ten years with the variety Gluyas Early, planted in mid-May, June, and July. During the last four years the mid-season variety Nabawa has also been planted in mid-April, May, and June.

The results obtained this year, together with the average results of previous years, are as under:—

TIME OF SEEDING EXPERIMENT.

Variety—Nabawa. 22 % Superphosphate—112 lbs. per acre. Seed—45 lbs. per acre.

Planted.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1929-32.	Percentage Yields, 1929–32
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
19th April	18 40	19 50	17 0	19 20	21 20	19 14	93	22 37	97
17th May	18 0	21 30	21 40	21 40	19 50	20 32	100	23 16	100
16th June	23 0	24 20	24 20	26 30	20 10	23 40	115	18 2	78

TIME OF SEEDING EXPEEIMRNT.

Variety—Gluyas Early. 22 % Superphosphate—112 lbs. per acre. Seed—45 lbs per acre.

Planted.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Per-centage Yields, 1932.	Avergae Yields per acre, 1923–32.	Per centage Yields, 1923–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
16th June	22 32	20 56	20 56	21 14	20 56	21 25	112	21 57	87
17th May	18 0	20 40	18 40	18 32	20 8	19 12	100	25 17	100
16th July	20 48	19 4	18 40	19 12	18 40	19 17	101	13 52	55

Subsequent to the seeding of the April plots no rain fell until 23rd. May, consequently these plots had no advantage regarding germination over the May planting, both plantings germinating on 1st June.

The June plots were particularly favoured by the heavy rains which fell during October, when 314 points were registered as against the average for that month of 85 points. These late rains also assisted the July planted plots, giving yields which were inconsistent with those of previous years.

Consideration of the average results obtained over a number of years shows that it is inadvisable to extend the planting period into the month of June. Should it not be possible to complete the seeding during May, it is preferable to plant a suitable midseason-maturing variety in April

Rate of Seeding Experiment.

As in previous years, this experiment was carried out with two varieties, viz., Nabawa, representing the free-stooling varieties, and Noongaar, representing the sparse-stooling varieties.

The land was ploughed in June, 1931, to a depth of 4 inches, and cultivated in September with a ten-furrow disc cultivating plough. It was harrowed early in May and disc cultivated before seeding. The results are set out in the following tables:—

RATE OF SEEDING EXPERIMENT.

Planted on 29th April, 1932. Variety—Nabawa. 22 % Superphosphate—112 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Per-centage Yields, 1932.	Average Yields per acre, 1913-32.*	Per-centage Yields, 1913–32*
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
30 lb.	14 16	16 0	14 40	16 40	15 44	15 28	92	19 10	95
45 lb.	17 20	18 16	15 4	17 20	15 44	16 45	100	20 16	100
60 lb.	17 36	17 44	15 12	16 48	13 52	16 14	97	20 18	100

* Excluding 1914.

RATE OF SEEDING EXPERIMENT.

Planted on 2nd June, 1932. Variety—Noongaar. 22 % Superphosphate—112 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1913-32*.	Percentage Yields, 1913-32*.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
30 lb.	19 52	17 20	15 28	21 28	22 32	19 20	87	18 31	96
45 lb.	22 16	19 12	20 24	25 36	24 8	22 19	100	19 10	100
60 lb.	18 24	17 20	25 44	24 16	21 20	21 25	96	18 50	98

* Excluding 1914.

These results again indicate that in this district it is unnecessary to sow either the sparse or the free-stooling varieties at a rate greater than 45 lb. per acre.

Rate of Application of Superphosphate Experiment.

This experiment is divided into two sections, in each of which plots treated with 150 lb. of superphosphate are regarded as controls. Thus in Section 1 the rates of 300 lb. and 225 lb. per acre are compared with the control rate of 150 lb. per acre, and in Section 2 the rate of 75 lb. per acre and no superphosphate are compared with the same control rate of 150 lb. The results obtained are shown hereunder:—

RATE OF SUPERPHOSPHATE EXPERIMENT.

Planted on 13th May, 1932 Variety—Gluyas Early Seed—45 lbs. per acre.

Rate of Application of 22 per cent. Superphosphate per Acre	Computed Yields per Acre. Sec. 1.	Sec. 2	Sec. 3	Sec. 4	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1922	Average Yields per acre, 1929 32	Percentage Yields, 1929 32.
	bus. lb	bus lb	bus lb	bus lb	bus. lb	bus lb.	%	bus lb	%
300 lb.	31 28	27 28	26 40	27 12	28 16	28 13	107	28 28	105
150 lb.	29 36	27 20	23 36	24 8	26 48	26 18	100	26 59	100
225 lb.	27 52	28 0	24 24	28 24	26 56	27 7	103	27 52	103

RATE OF SUPERPHOSPHATE EXPERIMENT.

Planted on 13th May, 1932 Variety—Gluyas Early Seed 45 lbs. per acre.

Rate of Application of 22 per cent. Superphosphate per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2	Sec. 3.	Sec. 4	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1929 32.	Percentage Yields, 1929-32.
	bus. lb.	bus lb.	bus. lb	bus. lb.	bus. lb.	bus lb.	%	bus lb	%
75 lb, ...	24 24	24 32	22 32	22 8	20 48	22 53	91	25 2	93
150 lb.	27 28	25 12	26 8	22 24	25 36	25 22	100	27 2	100
Nil	13 4	12 0	11 36	7 28	9 28	10 43	42	15 48	58

The average results for four years indicate that the rate of superphosphate applied per acre should be not less than 75 lbs. per acre, and that the most profitable rate under present economic conditions appears to be about 112 lb. per acre.

Seasonal Planting Experiment.

The objects of this experiment are—

(a) To ascertain the most suitable month to plant the late, mid-season, early, and very early maturing varieties of wheat; and

(b) to determine the most prolific of each of the above types.

To meet the requirements of the experiments three sections were needed, viz.:—

(a) Section 1, planted in April—Representing early planting.

(b) Section 2, planted in May—Representing mid-season planting.

(c) Section 3, planted in June—Representing late planting.

In all sections the standard midseason-maturing variety, Nabawa, was planted in the control plots.

The results are given below:—

SEASONAL PLANTING EXPERIMENT—APRIL PLANTING.

Planted on 19th April, 1932. 22 % Superphosphate—112 lb. per acre. Seed—45 lb. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre, 1932.	Percentage Yields, 1932.	Percentage Yields, 1928-32.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Yandilla King	Late	7 12	10 16	10 0	9 52	10 24	9 33	66	79
Nabawa ...	Midseason ...	12 40	15 44	11 36	16 16	16 16	14 30	100	100
Sutton ...	Late	7 28	7 52	6 24	7 12	9 36	7 42	53	*78
Bencubbin ...	Midseason ...	16 56	18 0	16 0	17 20	19 36	17 34	126	†117
Nabawa ...	Midseason ...	12 40	15 44	12 56	13 52	14 16	13 54	100	100
M 26	Midseason ...	13 44	13 36	10 56	11 44	14 8	12 50	92	...

* 1931-32. † 1920 1932.

SEASONAL PLANTING EXPERIMENT—MAY PLANTING.

Planted on 17th May, 1932. 22 % Superphosphate—112 lb. per acre. Seed—45 lb. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre, 1932.	Percentage Yields, 1932.	Percentage Yields, 1929-32.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Yandilla King	Late	11 10	14 20	11 40	11 10	10 50	11 50	63	74
Nabawa ...	Midseason ...	19 10	23 0	21 50	14 0	16 30	18 54	100	100
Sutton ...	Late	8 0	8 30	11 0	6 40	7 10	8 16	44	68
Bencubbin ...	Midseason ...	22 0	26 20	21 40	20 20	17 20	21 32	117	†115
Nabawa ...	Midseason ...	18 0	20 0	20 40	18 10	15 30	18 28	100	100
M 35	Early ...	14 10	17 30	17 30	11 0	16 20	15 18	83	...
Merredin ...	Early ...	21 30	23 50	24 0	18 10	21 0	21 42	123	113
Nabawa ...	Midseason ...	17 30	18 50	20 0	16 50	15 20	17 42	100	100
Geeralying ...	Early ...	17 20	20 40	18 20	14 40	15 0	17 12	97	100
Gluyas Early...	Early ...	19 40	27 50	21 40	18 0	20 10	21 28	116	111
Nabawa ...	Midseason ...	16 20	25 0	17 0	16 10	18 10	18 32	100	100
Totadgin ...	Early ...	24 0	28 10	21 10	22 20	22 20	23 36	127	*128
Carrabin ...	Early ...	15 50	16 10	12 10	11 20	12 40	13 38	71	94
Nabawa ...	Midseason ...	23 50	20 20	20 0	15 40	15 50	19 8	100	100
M 26	Midseason ...	17 40	11 50	10 0	10 40	13 0	12 38	66	...
S.H.J. ...	Early ...	21 10	14 40	11 0	12 20	14 50	14 48	80	92
Nabawa ...	Midseason ...	26 40	19 50	15 40	13 40	16 50	18 32	100	100
Noongaar ...	Very Early ...	17 50	12 40	7 40	7 10	12 10	11 30	62	101

* 1931-32. † 1929-32.

SEASONAL PLANTING EXPERIMENT—JUNE PLANTING.

Planted on 16th June, 1932. 22 % Superphosphate—112 lb. per acre. Seed—45 lb. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre, 1932.		Percentage Yields, 1932.	Percentage Yields, 1928-32.
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	%
Bencubbin ...	Midseason ...	25	12	24	32	22	56	27	20	21	20	24	16	117	*117
Nabawa ...	Midseason ...	23	44	19	52	20	0	21	4	18	40	20	40	100	100
M 26	Midseason ...	19	52	18	24	18	16	17	36	13	28	17	31	85	...
Merredin ...	Early ...	18	24	17	20	19	12	21	44	20	40	19	28	114	118
Nabawa ...	Midseason ...	17	4	17	44	16	48	19	36	14	32	17	9	100	100
Geeralying ...	Early ...	18	24	17	20	15	36	17	44	13	12	16	27	96	98
Gluyas Early...	Early ...	23	36	20	56	19	44	19	52	14	32	19	44	98	110
Nabawa ...	Midseason ...	27	28	20	0	18	32	19	20	15	44	20	13	100	100
Totadgin ...	Early ...	27	44	25	12	23	20	21	4	24	0	24	16	120	127
Carrabin ...	Early ...	20	32	16	48	21	36	16	0	13	44	17	44	86	95
Nabawa ...	Midseason ...	23	4	22	0	21	20	19	12	17	52	20	42	100	100
M 35	Early ...	17	44	18	0	18	24	12	24	17	4	16	43	81	...
S.H.J.	Early ...	19	52	19	4	18	8	10	32	13	52	16	18	85	89
Nabawa ...	Midseason ...	23	44	22	8	19	20	14	8	16	0	19	4	100	100
Noongaar ...	Very Early ...	26	32	23	20	22	56	18	24	17	52	21	37	114	115

The seasonal conditions were particularly unfavourable to the plots planted in April. Germination was retarded until the 1st June, as no rain of consequence fell until 23rd May. Consequently both the April and May plots germinated at the same time. All three plantings were affected by the disease Takeall, the two earlier sections probably suffering more than the later one.

The midseason-maturing variety, Bencubbin, has again shown to advantage in all sections, particularly when planted in April.

The results of the new early variety, Totadgin, in both the two later planting sections, confirm those of last year and are most encouraging.

Of the early maturing varieties, Totadgin, Gluyas Early, and Merredin have given the most satisfactory yields, while Noongaar has demonstrated its suitability as a very early maturing variety for late planting.

Generally the experiment indicates the suitability of early maturing varieties for the Merredin and similar districts. The relatively high yields obtained from the June planting sections are not consistent with previous years' results, but this is due to the abnormal season experienced during 1932.

Potash-Nitrogen Experiment.

The object of this experiment is to determine the effect upon the yield of the wheat crop of the application of—

(a) a nitrogenous fertiliser;

(b) a nitrogenous + a potassic fertiliser.

In addition to an application of superphosphate, sulphate of ammonia, a nitrogenous fertiliser, and muriate of potash, a potassic fertiliser, were used. These were applied to the respective plots, separately, a few days prior to the seed being planted. The results obtained are as follow:—

POTASH NITROGEN EXPERIMENT.

Planted on 20th May, 1932. Variety—Totadgin. Seed—45 lbs. per acre.

Rate of Application of Fertiliser per Acre.	Computed Yields per Acre. Section 1.		Section 2.		Section. 3.		Section 4.		Section 5.		Average Yields per acre, 1932.		Percentage Yields, 1932.
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%
112lb. Sulphate of Ammonia. 112lb. Superphosphate	24	32	26	48	24	40	21	44	22	32	24	3	98
112lb. Superphosphate ...	25	44	24	48	22	40	25	36	23	44	24	30	100
112lb. Sulphate of Ammonia, 112lb. Superphosphate, 56lb. Muriate of Potash	25	12	24	24	22	8	24	32	21	28	23	35	96

These results, which are for one year only, and hence cannot be taken as conclusive, show that no increase in yield is obtained when an application of superphosphate is supplemented with either a nitrogenous fertiliser or a nitrogenous and a potassic fertiliser.

Oat Variety Trial.

This experiment has been conducted for the past ten years. The variety Mulga, an early dual-purpose oat, is used as the control. Only early and midseason varieties are planted in this experiment, as the late maturing varieties have proved unsuitable for the district. The experiment is divided into hay and grain sections, and includes five varieties.

The yields obtained from both hay and grain sections are given below:—

OAT VARIETY TRIAL—GRAIN YIELDS.

Planted on 27th April, 1932. 22 % Superphosphate—112 lb. per acre. Seed—40lb. per acre.

Variety.	Maturity.	Computed Yields per Acre. Section 1.	Section 2.	Section 3.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1930–32.	Percentage Yields, 1930–32
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
ulga	Early ...	33 0	36 16	33 16	34 11	100	36 32	100
ldgee ...	Midseason ...	46 8	41 24	38 8	42 0	123	39 5	106
uyra	Midseason ...	36 0	34 0	24 0	31 13	85	37 24	98
ulga	Early ...	38 0	35 24	36 16	36 27	100	38 10	100
ulga	Early ...	39 0	33 0	38 8	36 29	100	38 21	100
alestine ...	Early ...	29 16	30 32	30 32	30 13	83	37 18	97
urt's Early ...	Early ...	28 16	27 8	28 0	27 35	77	37 18	95
ulga	Early ...	37 32	34 24	36 8	36 8	100	39 14	100

OAT VARIETY TRIALS—HAY YIELDS.

Planted on 27th April, 1932. 22 % Superphosphate—112lb. per acre. Seed—40lb. per acre.

Variety.	Maturity.	Computed Yields per Acre. Section 1.	Section 2.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre. 1930–32.	Percentage Yields, 1930–32
		cwt. qrs. lb.	cwt. qrs. lb.	cwt. qrs. lb.	%	cwt. qrs. lb.	%
Mulga	Early ...	48 2 24	48 1 20	48 2 8	100	55 2 22	100
Gidgee ...	Midseason ...	29 3 4	32 3 12	31 1 8	64	59 2 10	107
Guyra	Midseason ...	29 0 16	30 3 20	30 0 4	62	49 0 24	90
Mulga	Early ...	47 2 16	40 1 4	48 1 24	100	54 2 18	100
Mulga	Early ...	43 3 12	44 1 4	44 0 8	100	52 1 26	100
Palestine ...	Early ...	28 3 12	31 2 24	30 1 4	69	4[illegible] 1 26	85
Burt's Early ...	Early ...	32 3 4	31 2 0	32 0 16	68	48 1 6	91
Mulga	Early ...	47 1 12	46 3 4	47 0 8	100	53 1 4	100

In 1930 the arrangement of this experiment was altered to facilitate harvesting operations, and in consequence the average results of the last three years only are shown.

This year, in the grain section, the highest average yield was obtained from the midseason variety Gidgee. The standard early variety Mulga, which was used as the control, has given highly satisfactory yields both for this and the previous two years. Neither Burt's Early nor Palestine, both early oats, have proved as satisfactory as they were during the previous two years.

In the hay section Mulga has this year undoubtedly proved to be the best variety. The comparative yields from all other varieties are well below those obtained in previous years.

FIELD EXPERIMENTS WITH WHEAT, 1932.

YILGARN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
R. W. PRUNSTER, Farm Manager.

The monthly rainfalls as recorded at the farm during 1932, together with the averages for the past five years, are set out hereunder:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for Year.
1932 ...	58	86	61	65	186	92	121	278	53	210	940	...	36	1,196
Av. 5 years	38	68	48	84	201	134	107	136	48	61	687	77	55	1,057

Although small falls were recorded during the summer and autumn months, they were of little benefit for working the fallow wet, and the normal seasonal rains did not commence until the 28th May, some six weeks later than usual. This gave a late start to all crops planted during April and May. Normal falls of rain were recorded during June and July, while the recording for August was some 142 points above the average for the past five years. Two heavy frosts in September adversely affected the growth of the more forward crops. The heavy rains experienced during October enabled the later maturing varieties to mature under satisfactory conditions in spite of their late start. These late rains were of particular benefit to crops planted in June and July.

The land on which the experiments were conducted was originally timbered with salmon gum and gimlet. During June, 1931, it was disc ploughed to a depth of four inches. This was followed by a springtyne cultivation about the middle of September. During late March and early April, after 60 points of rain, the plots were disc cultivated in order to break up patches which had set down hard and to destroy weed growth. Immediately prior to seeding, the land was cultivated with a springtyne implement.

Time of Seeding Experiment.

The object of this experiment is to determine the most suitable month to plant the wheat crop. To meet the requirements of the experiment, two varieties of different maturity were used, Nabawa representing the midseason, and Gluyas Early the early maturing varieties.

The Nabawa plots were planted in mid April, May and June respectively, and the Gluyas Early plots were planted in mid May, June and July. Each plot was repeated five times.

The yields obtained from the different plantings are given below:—

TIME OF SEEDING EXPERIMENT.

Variety—Nabawa. 22 % Superphosphate—112 lbs. per acre. Seed—30 lbs. per acre.

Time of Seeding.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1928-32.	Percentage Yields, 1928-32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
16th April	17 44	19 44	18 32	21 12	18 40	19 10	84	18 43	102
14th May	21 20	24 8	22 24	24 40	21 20	22 46	100	18 16	100
17th June	16 8	16 32	14 40	14 16	14 32	15 14	67	10 34	58

TIME OF SEEDING EXPERIMENT.

Variety—Gluyas Early. 22 % Superphosphate—112 lbs. per acre. Seed—30 lbs. per acre.

Time of Seeding.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1928–32.	Percentage Yields, 1928–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
17th June	16 16	13 44	14 56	14 8	13 4	14 26	69	12 11	69
14th May	21 20	22 16	21 12	19 28	19 44	20 48	100	17 31	100
15th July	15 36	13 4	15 12	13 44	13 12	14 10	68	6 44	38

Both this year's results and the average results obtained over the five years that the experiment has been conducted show that it is inadvisable to extend the planting period into the month of June.

As indicated in the results, it is better to plant a suitable midseason maturing variety such as Nabawa during the month of April rather than to plant other wheat varieties after the end of May. Midseason varieties will give as good, if not better, results when planted in April rather than May, but with early maturing varieties the latter month is preferable.

Rate of Seeding Experiment.

The object of this experiment is to determine the most economic rate of seeding with—

(a) a midseason, free-stooling; and

(b) an early, sparse-stooling variety.

For the former the variety Nabawa was used, and for the latter the variety Noongaar.

The results of the experiment are as follow:—

RATE OF SEEDING EXPERIMENT.

Planted on 16th April, 1932. Variety—Nabawa. 22 % Superphosphate—112 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1928–32.	Percentage Yields, 1928–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
20 lb.	11 36	10 56	11 36	11 52	12 48	11 46	74	16 21	94
40 lb.	16 16	16 8	13 28	17 28	16 16	15 55	100	17 20	100
30 lb.	16 24	14 8	13 4	16 16	17 28	15 28	97	16 53	97

RATE OF SEEDING EXPERIMENT.

Planted on 25th May, 1932. Variety—Noongaar. 22 % Superphosphate—112 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1928–32.	Percentage Yields, 1928–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
20 lb.	9 20	8 24	8 8	9 44	8 16	6 46	86	13 14	94
40 lb.	10 48	9 52	10 24	9 36	10 32	10 14	100	14 1	100
30 lb.	9 12	8 40	10 40	8 40	9 20	9 18	91	13 49	98

Both this year's results and the average results obtained over five years indicate that the rate of 20 lbs. per acre is insufficient for both the free and the sparse stooling varieties.

With the free stooling variety the rate of 40 lbs. per acre shows a slight advantage over the rate of 30 lbs. per acre.

With the sparse stooling variety, this year's results are decidedly in favour of the rate of 40 lbs. per acre, although the average results do not show such a great advantage over the lesser rate of 30 lbs. per acre.

Rate of Application of Superphosphate Experiment.

The object of this experiment is to determine the most economical rate to apply superphosphate to the wheat crop.

This experiment is divided into three sections, in each of which plots treated with 150 lb. of superphosphate are regarded as controls. Thus, in Section 1, the rates of 300 and 225 lb. per acre are compared with the control rate of 150 lb. per acre, and in Section 2 the rates of no application and 75 lb. per acre are compared with the control rate of 150 lb.

During the period of growth, it was noticeable that the plots which had received no application of superphosphate were later in maturing.

An outside factor interfered with Section 1 of the experiment, rendering the results unreliable. They have, therefore, been discarded. The average results, however, for previous years (1929-31) are shown below, together with this year's results for Section 2.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Variety—Gluyas Early. Seed—30 lb. per acre

Rate of Application of 22 per cent. Superphosphate per Acre.	Average Yields per acre. 1931.		Percentage Yields, 1931.	Average Yields per acre, 1929-31.		Percentage Yields, 1929-31.
	bus.	lb.	%	bus.	lb.	%
300 lb.	18	25	105	15	7	98
150 lb.	17	54	100	15	31	100
225 lb.	19	1	106	15	13	98

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Planted on 12th May, 1932. Variety—Gluyas Early. Seed—30 lbs. per acre.

Rate of Application of 22 per cent. Superphosphate per Acre.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre, 1932		Percentage Yields, 1932.	Average Yields per acre, 1929-32.		Percentage Yields, 1929-32.
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	bus.	lb.	%
Nil	13	36	14	0	14	56	14	32	15	44	14	34	74	11	21	64
150 lbs.	18	0	17	20	20	8	21	4	21	36	19	38	100	17	38	100
75 lb.	14	40	16	32	17	20	18	24	18	16	17	2	87	15	19	87

These results show that increased yields are obtained when superphosphate is applied up to 150 lb. per acre.

Under present economic conditions, the most economical rate of application appears to be between 100 and 112 lb. per acre.

Seasonal Planting Experiment.

The objects of this experiment are:—

(a) To ascertain the most suitable month to plant the midseason, early, and very early maturing varieties of wheat;

(b) To determine the most prolific of each of the above types.

To meet the requirements of the experiment, three sections were needed, viz.:—

(a) Section 1, planted in April, representing early planting;

(b) Section 2, planted in May, representing midseason planting;

(c) Section 3, planted in June, representing late planting.

Each section, planted in its respective month, was repeated five times, all plots being eventually harvested for grain.

As no rain of consequence fell until 28th May, the germination of the plots planted in April was delayed until early June. Consequently this section had no advantage over that planted in May.

Hereunder are shown the results obtained during 1932, together with the average percentage results of the previous four years.

During this period (1928-31) the variety Nabawa had been planted in the control plots, but the average percentage results are shown hereunder calculated on the basis of Gluyas Early controls. This enables a comparison to be made with the results for 1932 when the variety Gluyas Early was used in the control plots.

SEASONAL PLANTING EXPERIMENT—APRIL PLANTING.

Planted on 15th April, 1932. 22 % Superphosphate—100 lb. per acre. Seed—28 lb. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Percentage Yields, 1929-31.
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Noongaar ...	Very Early ...	8 16	6 24	5 12	4 48	5 20	6 0	40	69
Gluyas Early...	Early ...	16 8	13 44	16 32	16 16	12 48	15 5	100	100
Totadgin ...	Early ...	16 16	14 48	18 24	18 32	14 24	16 29	110	...
Bencubbin ...	Midseason ...	16 0	14 24	19 28	17 12	12 8	15 50	110	144*
Gluyas Early ...	Early ...	14 24	11 20	18 32	15 44	12 16	14 27	100	100
Nabawa ...	Midseason ...	13 4	12 24	19 36	18 16	15 28	15 46	109	111

* 1930-31.

SEASONAL PLANTING EXPERIMENT—MAY PLANTING.

Planted on 16th May, 1932. 22 % Superphosphate—100 lb. per acre. Seed—28 lb. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Per centage Yields, 1928-31.
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Noongaar ...	Very Early ...	6 8	6 8	5 28	7 4	8 40	6 42	39	103
Gluyas Early...	Early ...	14 48	18 0	18 0	17 52	16 24	17 1	100	100
Geeralying ...	Early ...	11 20	12 40	15 4	10 16	12 16	12 19	72	96
Merredin ...	Early ...	14 0	16 40	18 48	8 32	15 12	14 38	86	88
Gluyas Early...	Early ...	15 36	17 28	18 56	16 0	17 36	17 7	100	100
Totadgin ...	Early ...	19 4	19 20	20 40	16 56	19 28	19 5	112	...
S.H.J. ...	Early ...	14 40	15 52	16 56	13 4	14 24	14 59	90	88
Gluyas Early...	Early ...	16 8	18 24	16 24	16 56	15 28	16 40	100	100
Carrabin ...	Early ...	18 8	18 24	17 20	16 0	14 16	16 50	101	91
Bencubbin ...	Midseason ...	18 40	21 36	16 48	18 32	15 4	18 8	116	106*
Gluyas Early...	Early ...	16 24	17 28	16 16	13 36	14 16	15 36	100	100
Nabawa ...	Midseason ...	14 32	17 28	18 16	9 28	17 12	15 23	98	92

* 1930-31.

SEASONAL PLANTING EXPERIMENT—JUNE PLANTING.

Planted on 17th June, 1932. 22 % Superphosphate—100 lb. per acre. Seed—28 lb. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre, 1932.	Percentage Yields, 1932.	Percentage Yields, 1928-31.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Bencubbin ...	Midseason ...	16 24	19 20	13 44	18 8	18 48	17 17	121	107*
Gluyas Early...	Early	13 36	15 28	12 0	16 0	14 32	14 19	100	100
Nabawa ...	Midseason ...	16 32	18 24	14 32	17 52	15 28	16 34	116	87
S.H.J. ...	Early ...	12 40	14 56	10 16	14 0	13 4	12 59	89	77
Gluyas Early...	Early ...	13 20	16 40	12 8	15 4	15 28	14 32	100	100
Carrabin ...	Early ...	13 28	14 40	10 48	14 40	15 12	13 46	94	93*
Merredin ...	Early ...	16 0	17 28	13 12	13 44	12 56	14 40	108	86
Gluyas Early	Early ...	13 52	15 36	13 52	11 44	13 4	13 38	100	100
Totadgin ...	Early ...	15 12	18 0	14 24	17 44	13 36	15 47	116	...
Noongaar ...	Very Early ...	16 56	16 48	15 4	13 52	14 16	15 23	110	113
Gluyas Early ...	Early ...	15 20	16 24	12 16	12 24	13 20	13 58	100	100
Geeralying ...	Early ...	14 32	15 4	10 56	11 4	12 48	12 53	92	90

* 1930-31.

The abnormal seasonal conditions of 1932, i.e., delayed seeding rains and also late spring rains, have resulted in the actual yields obtained from all plantings being somewhat similar.

The midseason varieties, Bencubbin and Nabawa, and the early variety, Totadgin, have shown to advantage in all sections, while the standard very early variety, Noongaar, has again proved satisfactory for late planting.

Generally the experiment indicates the advisability of commencing wheat seeding operations with a midseason maturing variety such as Bencubbin or Nabawa planted in April, followed by planting the major portion of the crop in May, the main seeding month, with an early maturing variety such as Gluyas Early or Totadgin and finishing with the proved very early variety, Noongaar.

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OAT VARIETY TRIALS IN THE SOUTH-WEST.

G. K. BARON-HAY, Superintendent of Dairying.

Oat variety trials which are conducted annually by officers of the Dairy Branch were continued during 1932, the results from which are given hereunder:—

At Dardanup the experiment was conducted on the property of J. H. Brett. The results as reported by Dairy Inspector Giles are as follow:—

Soil: Dark friable loam adjacent to creek. Old grass land.

Original Timber: Red Gum.

Drianage: Insufficient.

Rate of Seeding: 2 bushels per acre.

Fertiliser: Superphosphate at the rate of 1¼ cwts. per acre.

Date of Seeding: June 21st. Delayed owing to heavy rains.

Rainfall: During the growing period the rainfall was not recorded.

The variety "Imbros" was included in this trial.

The yields obtained were as follow:—

Green Material.

Variety.	Yield.				Percentage Yield.
	tons	cwts.	qrs.	lb.	
Algerian	7	5	3	6	100
Guyra	6	5	3	11	86
Burt's Early	6	2	0	17	84
Mulga	5	3	1	17	71
Imbros*	10	5	2	26	140

* Included 1932 for first time.

Conditions throughout the greater part of the season were bad, owing to the extreme wet conditions, consequently the crop suffered from waterlogging up to the end of September, but made excellent recovery from then on to harvesting time.

At Denmark experiments were conducted on the properties of J. Illsley, Group 41; and E. A. Russell, Group 42. The results as reported by Agricultural Adviser Elliott are as follow:—

J. Illsley, Group 41, Denmark.

Soil: Red karri loam. Old pasture land carrying Subterranean Clover, Red Clover, Cocksfoot, and Ryegrass.

Cultivation: Ploughed on 9th May and harrowed next day. The seed and fertiliser were broadcasted and harrowed in on 16th May.

Rate of Seeding: 2 bushels per acre.

Fertiliser: 2 cwts. superphosphate per acre.

The yields were as follow:—

Green Material.

Variety.	Yield—Average 2 plots.				Percentage Yield.
	tons	cwts.	qrs.	lbs.	
Algerian	4	19	2	0	100
Guyra	5	19	0	0	120
Burt's Early	4	17	1	0	98
Mulga	4	11	3	9	93

During the first two months the "Burt's Early" and "Guyra" were the most outstanding. At the time of cutting, the "Algerian" and "Guyra" were not so mature as the other two varieties, and yet they returned a greater bulk.

The growing conditions during the earlier stages were unfavourable, owing to the continued wet conditions which partly waterlogged the field.

E. A. Russell, Group 42, Denmark.

Soil: Grey to black jarrah and sheoak ground newly cleared.

Cultivation: Ploughed and harrowed twice early in May. The seed and fertiliser were broadcasted and harrowed in on 18th May.

Rate of Sowing: 2 bushels per acre.

Fertiliser: 2 cwts. superphosphate per acre.

The yields were as follow:—

Green Material.

Variety.	Yield—Average 2 plots.				Percentage Yield.
	tons.	cwts.	qrs.	lbs.	%
Algerian	3	4	0	21	100
Guyra	2	19	1	19	93
Burt's Early	2	3	1	0	67
Mulga	2	10	1	18	78

A section of the "Guyra" and "Mulga" was a complete failure, owing to the excessively wet conditions and faulty drainage. The "Burt's Early" was the most forward in the earlier stages of growth. As was the case with the experiment at J. Illsley's, the "Algerian" and "Guyra" was not so mature as the other varieties.

For the Denmark area the experiments over a number of years show that "Burt's Early" is the best variety to grow for early feed and that "Algerian" and "Guyra" are preferable for hay.

All the above yields are given on their green weight basis. Farmers wishing to compute the yields to a hay basis can estimate that 100 tons of green weight produce 33 tons hay.

The average of the 23 trials conducted throughout the South-West are shown in the following table:—

Variety.	Yield: Average 66 plots = 23 trials.				Percentage Yield.
	tons	cwts.	qrs.	lbs.	%
Algerian	2	8	0	20	100
Lachlan	2	2	3	9	88
Guyra	2	2	0	14	87
Burt's Early	1	14	1	0	70
Mulga	1	13	3	0	69

These results indicate that for a hay crop "Algerian" has proved more suitable than the other varieties, but in almost every centre it has been noted that for early grazing "Burt's Early" and "Mulga" were preferable, and that the fodder provided by these varieties was more relished by stock than that of "Algerian."

SUBTERRANEAN CLOVER.

(*Trifolium subterraneum*, Linn.)

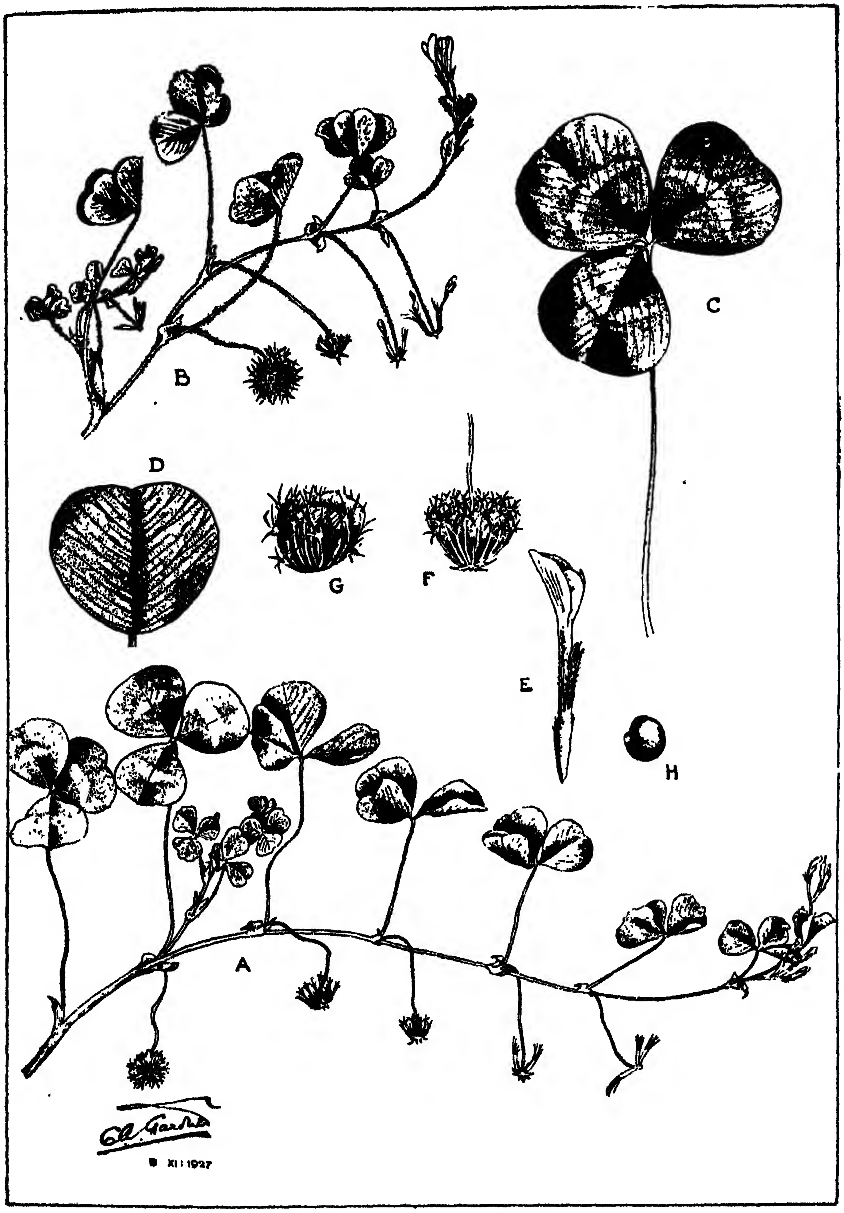
C. A. GARDNER and T. C. DUNNE.

Subterranean Clover received its name from its habit of burying the seed heads in the soil. It is one of the most important annual clovers cultivated in the South-West of Western Australia, and is the most extensively grown species. The first introduction appears to have been made as far back as 1902, but the clover first came into prominence between 1914 and 1917, the seed having been both introduced from South Australia and naturalised here. Such promising results were obtained, that before ten years had elapsed it had become the principal pasture plant of the South-West, being widely grown for pasturage, hay, and ensilage. The clover is highly nutritious, both when grazed or cut for hay. On areas top-dressed with superphosphate, young pastures have given results as high as 30 per cent. protein and 1.5 per cent. phosphorus, calculated on the basis of dry material. The composition of hay will vary from 12 to 18 per cent. protein and .5 to .8 per cent. phosphorus, depending upon the earliness of cutting.

At the present time, where permanent pastures are being established, Subterranean Clover is being to a large extent supplemented by perennial species, but it remains of considerable value by virtue of its ability to thrive in virgin soils, thus preparing the way for permanent pasture constituents, and it still furnishes one of the principal hay crops of the lower South-West. The area of distribution of this clover has extended considerably during recent years, until now it is becoming equally important in the lighter soils of the Great Southern and Midlands districts, and with the evolution of further suitable strains it is expected that the range of the plant will be still further increased.

Description of Plant.

An annual plant of diffuse or spreading habit, extending to a diameter of up to four feet, and usually nine to 18 inches in height under good conditions of growth, usually silky-hairy in the earlier strains, but varying from coarsely



SUBTERRANEAN CLOVER
(*Trifolium subterraneum, L.*).

PLATE I.

Explanation of Plate.

A. and B.—Portion of plant showing habit and development.
C.—Leaf showing whitish crescent-shaped markings.
D.—Leaflet with brown flecking (on veins near midrib).
E.—Flower.
F.—Maturing seed head.
G.—Ripe burr with three pods.
H.—Seed.

hairy to almost hairless. Stipules broad, lanceolate in outline, acute or obtuse. Leaves on long leaf-stalks, erect, the leaves broadly obovate to almost orbicular with the secondary nerves spreading obliquely from the midrib. Flowers usually inconspicuous, produced on long axillary peduncles which are usually hidden amongst the leaves; peduncles at first spreading or erect, but later arching downwards and lengthening after the flowering period, and burying the seed head in the soil.

The flowers are in heads of from three to seven, surrounding a central cluster of abortive flowers which are reduced to short whitish barbed processes, representing the calyx teeth of the abortive flowers. The processes stand erect in the centre of the flower-head, surrounded by the deflexed flowers. As the ripening seed-head curves downwards, the flowers or seed pods assume an erect position, and the barbs of the centre point downwards to the soil, which they enter, acting as anchors which secure the seed-head in the soil. This penetration of the soil can only take place if the soil is loose or moist, or lightened by humus or litter on the surface.

The calyx of the flower varies from green to red in colour; the tube is devoid of hairs, and many-nerved when in fruit, and the awl-like teeth are erect and hairy. The colour of the calyx-tube and calyx-teeth are important in the recognition of the various strains. The standard is long and narrow, and much exceeds in length the calyx-teeth. Although usually white with faint voilet-coloured lines on the back, a pink-flowered form occurs.

The pod contains one seed, which when ripe is large, and a lustrous purple-black in colour. Although usually globular, in the late, or Brunswick variety, it is oval in outline; the radicle (primary root contained within the seed) is usually indicated by a small lateral swelling or protuberance. Three seeds are normally produced in the seed-head or "burr," although the number may be less. They remain within the persistent pods within the burr, from which they can only be readily separated by a process of dehulling. These seeds are easily recognised from those of any other clover by reason of their shape, size and colour.

The original home of the species is Southern Europe and Asia Minor.

The plant is a winter and spring growing annual which dies off with the advent of warm summer weather.

As with other plants which are cultivated intensively, Subterranean Clover has produced several strains of closely related but apparently distinct pure-breeding "varieties" with perhaps cross-breds between those strains which are not pure-breeding. Although the results of the scientific determination of these strains of Subterranean Clover are not yet complete, the following fairly well-marked strains and variety are separable and may be determined by the use of the following key and reference to the plate:—

A.—Stipules shortly acute or mucronate; seeds globular, the radicle usually not very prominent.

a. Calyx-tube pale green with green teeth; plant almost prostrate with scanty foliage and hairy stems; leaflets without markings, when full-grown, but usually a crescent when young .. 1. **First Early Strain.**

b. Calyx-tube red, at least in the upper half.

a. Leaflets without markings .. .. .. 2. **Daliak Strain.**

b. Leaflets with a transverse whitish crescent-shaped mark near the centre, the cusps projecting downwards.

I. Leaflets under 2 cm. (⅞in.) long, with a chocolate-brown area below the crescent; flowering season during August* .. .. 3. **Northam Early Strain.**

II. Leaflets 2 cm. long or longer; leaflets with or without a few brown fleckings on the veins, but no definite area below the crescent. Flowering season later than mid-September* .. .. 4. **Midseason Strain.**

B.—Stipules acuminate (*i.e.*, gradually narrowed into a long fine point); seeds longer than broad, with a prominent radicle .. .. 5. **Brunswick Late Variety.**

There is also a pink-flowered form with an entirely green calyx, and a deep rose-pink corolla. The leaves are without any markings. It is probably a form of the First Early Strain.

1. *First Early Strain.*—This strain came originally from Dwalganup, where it was grown by Mr. P. D. Forrest. It is a small plant which has stout trailing stems with comparatively little leafage. Brown fleckings appear in the younger leaves, and white crescent-shaped markings, but the latter disappear in the adult leaf. The thick stems are very hairy. This strain commences to flower early in August. It is a very hardy strain and the one most suitable for the areas of lighter rainfall. The strain is sometimes known as "Dwalganup Clover," or "very early variety," and has been naturalised in the Blackwood district for over 40 years. It is supposed to have been accidentally introduced in Rye Grass seed, probably from Europe. The calyx-tube and teeth are green.

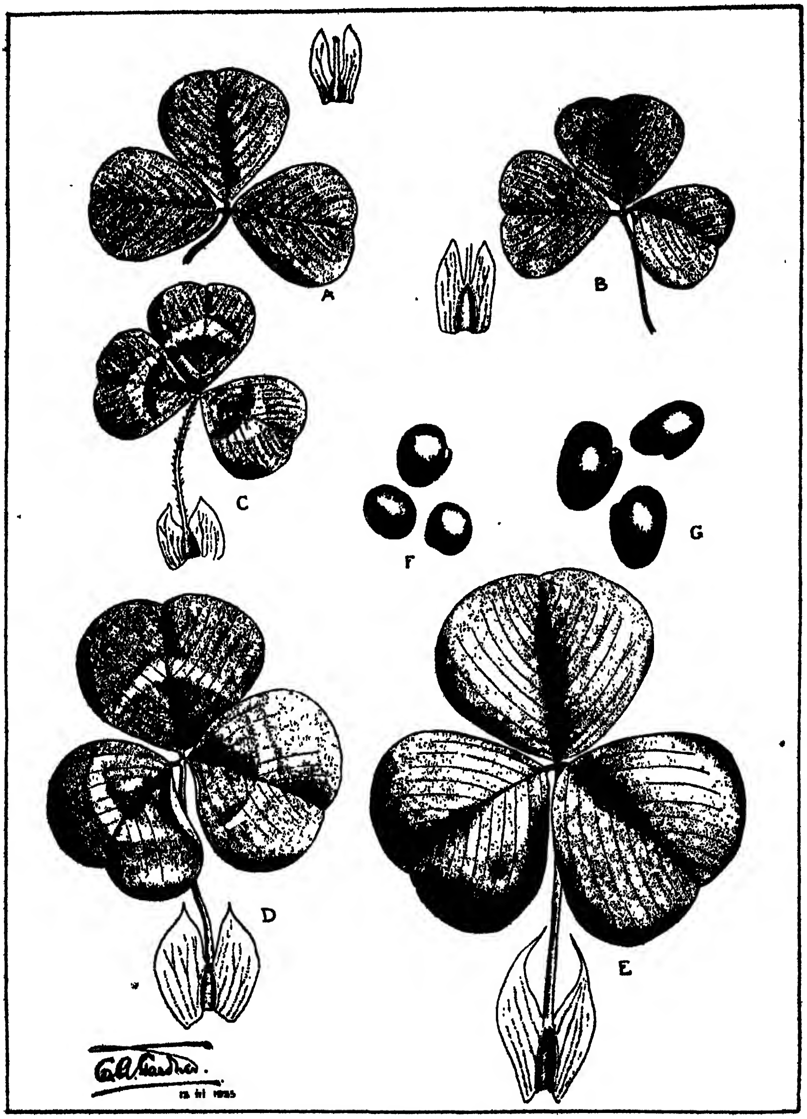
2. *Daliak Strain.*—This strain, also known as "Daliak Variety," or "Monger's Variety," may be distinguished from the First Early strain by its reddish calyx-tube, and the absence of a crescent, even on the young leaves. Like the First Early strain the Daliak strain may have brown fleckings on the younger leaves, but these disappear with age. In both strains the stipules are broad and somewhat obtuse, the stems and leaf-stalks very hairy, and the adult leaves without markings. The Daliak strain was accidentally introduced into the York and Muresk districts by sheep. Sheep have materially assisted in spreading the plant. The flowering season is towards the end of August, about a fortnight later than the First Early strain.

3. *Northam Early Strain.*—This is an early strain which has a white crescent-shaped marking on the leaflet subtended by a chocolate-coloured area. The foliage is more sparse than in the Midseason strain, and the leaflets are smaller, and often rusty-hairy beneath. The flowering season is towards the end of August. This strain has only recently come under observation in the Northam district, where it was found by Mr. A. B. Adams.

4. *Midseason Strain.*—The Midseason strain is the one most commonly cultivated in the lower South-West and the one which has attracted the most attention. The white crescent of the leaflets is most marked, and the plants are densely foliaged. The plant is more prolific than the preceding strains, and frequently attains a height of 18 inches. The calyx is red with green teeth, and the plants are not as a rule very hairy. Some brown flecking usually occurs on the secondary nerves. The flowering season is later than mid-September. This strain is suitable for cultivation as far East as the 25in. isohyet.

5. *Brunswick Late Variety.*—This variety can easily be distinguished from the above strains by its much larger leaves which are usually hairless and of delicate texture, and its seeds which are not globular as in the foregoing, but more oblong with a decided radicle or protuberance on the side. It is a more upright

* The flowering period referred to is from data obtained in the Northam district, and some variation may be expected under dissimilar conditions.



SUBTERRANEAN CLOVER.

PLATE II.

Leaves.

A.—First Early Strain.
B.—Daliak Strain.
C.—Northam Early Strain.
D.—Midseason Strain.
E.—Brunswick Late Variety.

Seed.

F.—Midseason Strani.
G.—Brunswick Late Variety.

Icon. origin.

and strong growing form with long pointed stipules. The variety has various names such as "Wenigup Clover," "Late Variety," and "Brunswick Clover." It first appeared in the Wenigup district, near Bridgetown, but nothing is known of its origin. This variety, which produces the greatest bulk of feed of any of the forms, is only siutable for cultivation in the wetter areas, where it flowers in late October or early November.

The three early strains normally bury all of their seeds, but the Midseason Strain and Late Variety only bury a proportion of the burrs. Hard seeds are present in all strains, especially the early strains, but the percentage is relatively unimportant.

Distribution.

Subterranean Clover is adapted to almost all soils except the dry sandy soils and the wet swampy lands. Although it will withstand considerable flooding during the winter, provided it makes early growth, it is not as well suited for swampy or wet areas as Drooping-flowered Clover. Subterranean Clover has been found suitable for the lighter classes of country, the well-drained clay soils, and the gravelly loams of the South-West and the Darling Range. The species can be grown in any of these types of country within the 17-inch isohyet—an area exceeding the range of Jarrah, and including a large stretch of the Great Southern and Midlands districts. This range may in the future be extended as earlier and hardier strains are evolved, and it is not improbable that at the present time some measure of success might attend endeavours to grow the earlier strains with a rainfall as low as 15 inches.

The Midseason strain and Late Variety are cultivated within the 25 and 35 inch isohyets respectively. Within these areas the wet season is of longer duration than in the lighter rainfall areas, and these two types of clover require this longer growth period in which to mature.

The three early strains are suitable for the zone with an annual rainfall of 17-25 inches in which they make early growth and ripen their seeds earlier than do the later strains. There is less foliage with these plants, and they are more hardy, and a large amount of seed may be formed.

Establishment.

In establishing this clover clean seed alone should be used. Burr harbours and distributes such pests as Lucerne Flea, Red Mite, and Dodder.

1. *Midseason strain and Late variety.*—These clovers, which are grown only in the wetter parts of the South-West, are usually sown as pioneer or introductory plants in pasture establishment. They are sown either (a) in virgin soil following burning, or (b) in cultivated land.

Sowing in virgin soil following burning is popularly known as "Sowing on the burn." Forest land is ringbarked and during the summer a running fire destroys the undergrowth and debris. In the autumn following the burning operation the seed is broadcast at the rate of from 2 to 4 lbs. per acre accompanied by an application of from 1 to 2 cwts. of superphosphate. The fertiliser and seed may be mixed immediately before broadcasting, and this method assists in the even distribution of seed. This is an admirable method of clearing the country in such areas if followed by grazing, and brings about a gradual disappearance of the scrub partly through the smothering effect which the clover has upon the young scrub shoots, and partly through the trampling and grazing of stock which consume a large amount of "roughage" in conjunction with the clover. This procedure can produce a stand of clover in the first season almost equal to that of cultivated land.

Sowing in cultivated land may be done with a without a cover crop. With a cover crop seed is sown at the rate of from 2 to 4 lbs. per acre, but if a cover crop is not sown, a heavier application of seed is advisable in order to produce a better stand during the first season. Seed should preferably be broadcasted, and only lightly covered with soil. If drilled there is a danger of planting the seed too deep. Fertiliser is applied at the same rate as for sowing on the burn.

2. *Early strains.*—These are grown in the areas of lighter rainfall where the season is shorter than in the wetter areas of the South-West. The clover is sown with a crop, usually with oats, and should not be sown through a drill with the grain and fertiliser, since this tends to bury the seed too deeply. It is best broadcasted at the rate of 2 to 4 lbs. per acre with the advent of the reliable winter rains. If sown without a crop a heavier sowing is advantageous.

Management.

Once Subterranean Clover is established it will increase and be spread by stock ingesting the burrs and passing some of the seeds in their droppings, especially on top-dressed pastures. Both cattle and sheep spread the clover readily in this way, and, in addition, the burrs are caught up in the wool of sheep and further distributed. This may account for the appearance of the plant in districts where it was previously unknown. Stock, apart from carrying the plants from paddock to paddock, may also carry it into the bush, and in this way, in certain areas, quite useful stands of the clover have been established with the aid of phosphatic manure. The clover should be permitted to make an appreciable growth before admitting stock—the lateral stems should be developed before this is done. If the crop is to be cut for hay, heavy winter grazing should not be permitted, especially in the districts of lighter rainfall. The plant has the ability of making a fair amount of growth during the cold weather, but it produces most of its bulk during the warm spring months.

When the crop is to be cut for hay or silage, this should be done as early as is compatible with obtaining a reasonable yield. Only a proportion of the burrs should be formed at this stage. With advancing maturity there is a definite decrease in the nutritive value of the clover, both the protein and phosphorus contents being considerably reduced. In older pastures containing a large percentage of adventitious grasses and weeds, such as Wild Geranium (*Erodium*), it is probably preferable to cut for silage. By this method the grasses and weeds which usually mature before the clover, and which would be quite innutritious as hay, may become of value owing to the changes taking place in the silo. Further, this method will help to reduce the number of weeds in the pasture in the subsequent year.

In the areas without summer rains, clover allowed to remain on the surface will cure into hay of a fair quality quite suitable for feeding sheep or dry stock. Where a good covering of clover has been secured, a scarifier run over the land in summer will bring to the surface a large number of the seed burrs, which are readily eaten by sheep. These being of high feeding value will be of great benefit in supplementing the low protein diet usually available to sheep during the summer months, the subsequent stand of clover not being impaired.

For the successful maintenance of Subterranean Clover, an annual application of soluble phosphate is essential. Superphosphate should be applied at the rate of 1 to 2 cwts. per acre during the autumn as soon as possible following the first rains. In districts which have a longer growing season, where a good regrowth may be expected after hay cutting, it is often advisable to apply a supplementary dressing of about 1 cwt. of superphosphate per acre in the spring.

After Subterranean Clover has been grown continuously for a number of years, a condition known as "clover-sickness" develops. This is accompanied by the ingress of a number of annual weeds, especially the poorer grasses. At this stage in the wetter areas the land should be ploughed, and cropped with oats, maize, or potatoes, thereby utilising the nitrogen accumulated during the years of clover pasture. In the following season the land should be allowed to revert to clover, when a good stand will be procured without reseeding. Alternatively, the clover may be ploughed up, for the introduction of perennial grasses and clovers. In the areas of lighter rainfall, when "clover-sickness" becomes evident, the land should be utilised for alternate fallowing and cropping for several seasons. The land may be re-seeded with clover for pasture when deemed advisable.

Dodder and Insect Pests.

Almost everywhere where Subterranean Clover is cultivated, Dodder is present to a greater or less extent. Much of its introduction is due to the former practice of establishing the clover through sowing infected clover burr. Dodder is a leafless parasite that feeds upon the stems and leaves of the clover, and has no connection with the soil. It forms small entanglements which become conspicuous during the months of September and October when the white blossoms, which grow in dense clusters, become evident in affected spots. These spots may be isolated patches of a few feet in diameter, or where unchecked they may become mor or less general throughout the pasture. It is important that the plant should be prevented from seeding. This may be done by cutting out the affected areas when they first come into flower, cutting as close as possible to the ground with a scythe. and either feeding the hay so obtained to stock, or, if there is any danger of some of the dodder plants having reached the seeding stage, the cut material should be burned. In such cases, feeding the hay to stock only spreads the weed, since the seeds are readily passed by stock in a viable condition. It is equally important in establishing the clover to obtain clean seed.

Where a crop is affected generally, the best plan is to cut for hay or silage at an early stage, before there is any chance of the seed having set. Where the weed is allowed to seed unchecked, it may spread to such an extent that the pasture become practically useless, and constitutes a menace, since Dodder spreads rapidly by means of its seeds.

Clover Springtail (Lucerne Flea) and Red-legged Earth Mite have only become serious pests during recent years. While both these pests, if present, will attack new sowings of Subterranean Clover, their ravages are usually most apparent in the older established pastures. In fact, they are generally seen at their worst when the pastures are showing signs of clover-sickness, and when a large amount of decaying organic matter is present in the surface layers of the soil, or upon the surface. Two management methods have proved fairly successful in combating the Clover Springtail and to some extent the Red-legged Earth Mite.

With the advent of warm dry weather, the Clover Springtail deposits a number of resistant summer eggs. If the clover is ploughed in, and with it the Clover Springtail, before this period, the insect may be smothered and to a great extent controlled during the following season. However, as the worst effects are usually noticed in clover-sick fields, it is probably advisable to follow ploughing by a season's cropping before allowing the field to revert to pasture. The new vigorous stand of clover thereafter obtained should be relatively free from these pests for a few years.

Burning a pest-infested field during the summer also meets with some measure of success. It is essential, however, that the field be not grazed too heavily before

burning, in order that an even and complete burn may be secured. A fast-running fire is of little use, since many of the crevices in which the eggs are deposited will remain unaffected by the heat. A good creeping fire which may be secured by burning back against the wind, will destroy large numbers of the eggs, without damaging the burrs, and a clean stand should result in the following season.

A Clover Springtail parasite (*Biscirus lapidarius*), a predatory mite which feeds upon the Clover Springtail itself, has recently been discovered. It is hoped that with the increase and distribution of this mite, the Springtail may assume less serious proportions in the future.

FIELD EXPERIMENTS WITH WHEAT AND OATS, 1932.

WONGAN HILLS LIGHT LANDS FARM.

I. THOMAS, Superintendent of Wheat Farms.

A. R. VENTON, Farm Manager.

The following table shows the rainfall as recorded at the farm during the past two years and also the averages as recorded at the town of Wongan Hills, four miles distant, over the nineteen years previous to 1932:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1932 ...	50	13	119	95	292	184	393	554	76	178	1,027	6	24	1,934
1931 ...	...	9	6	101	209	174	265	174	143	73	1,038	...	137	1,291
Av. 19 yrs.	34	51	87	66	198	282	272	193	128	92	1,165	37	58	1,498

The season opened fairly well, there being sufficient rain early in April to germinate many weeds and give the early sown wheat and oats a good start. From then on, until the latter part of May, there was sufficient warm weather to enable weeds to be dealt with. Late in May moderately heavy rains fell. Many frosts were experienced from June onwards, with exceedingly heavy rains in July and August. The exceptionally wet and cold conditions which prevailed are generally considered to be very unfavourable for this class of country, but excepting on the low lying and undrained flats, also on some of the deep sandy patches, the crop did not appear to be affected very much. In August and September the low-lying portions of the crop were very badly waterlogged, and were very poor indeed, being far below the remainder in general appearance. However, with warmer and drier conditions, a fairly good recovery was made at the end of October, and during November, although these portions did not equal the rest of the crop, being shorter and the ears much smaller.

The September rains were below the average, but excellent rains fell in October. The late rains were particularly helpful to those varieties which were sown after the middle of May and had not made much growth before wet and cold conditions prevailed.

The land on which the various experiments were carried out is a tussocky type of sandplain on a low-lying flat.

It was fallowed in June-July, 1931, with disc cultivating ploughs, and crossed with the same implements in August-September. In March 1932, it was disced to deal with suckers. Before seeding early in May, it was disced with the tandem disc and spring tyne cultivated. These operations left a good seed-bed besides dealing with weeds.

Time of Planting Experiment.

This experiment is being conducted to determine the most suitable month for planting the wheat crop in this district.

The early maturing variety, Gluyas Early, and the midseason-maturing variety, Nabawa, were used, the former being planted in mid-May, June, and July, and the latter in April, May, and June.

The April sown plots germinated and stooled well, and were robust throughout the season. The May sown plots also germinated well, but stooling was not so good, neither was growth so vigorous until October, when the general appearance improved considerably. The June and July sown plots were slow in germinating, and made little headway until October. The unusually wet and cold conditions obviously handicapped the late sown plots of both varieties.

TIME OF PLANTING EXPERIMENT.

Variety—Nabawa. Seed—45lbs. per acre. 22 % Superphosphate—120lbs. per acre.

Planted	Computed Yields per Acre.				Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1928–32.	Percentage Yields, 1928–32.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
April 15th	20 24	17 20	19 4	17 52	18 40	155	16 54	112
May 15th	12 24	11 12	12 48	11 52	12 4	100	15 10	100
June 15th	7 28	7 28	8 24	7 4	7 34	63	8 43	58

Section 5 discarded owing to interference by waterlogging.

TIME OF PLANTING EXPERIMENT.

Variety—Gluyas Early. Seed—45lbs. per acre. 22 % Superphosphate—120lbs per acre.

Planted.	Computed Yields per Acre.				Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1928–32.	Percentage Yields, 1928–32.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
June 16th	9 52	11 36	8 40	8 32	9 40	65	10 5	66
May 16th	16 56	14 8	14 8	14 8	14 50	100	15 14	100
July 15th	2 40	2 48	3 28	2 32	2 52	19	5 30	37

Section 5 discarded owing to interference by waterlogging.

The results again confirm those of former years, viz., it is essential for seeding operations to be completed by the end of May.

Rate of Seeding Experiment, Wheat.

As was the case in previous years, the experiment was conducted with two varieties, Nabawa (midseason maturing) representing the free stooling, and S.H.J. (early maturing) representing the sparse stooling types respectively.

Germination and growth was good with both varieties. Early in the season the light sowing appeared somewhat sparse, more particularly with the sparse stooling variety S.H.J., but as the season advanced this became less apparent.

At maturity, the ears of both varieties were noticeably small on the plots receiving the heavy rate of seed.

RATE OF SEEDING EXPERIMENT.

Planted April 29th, 1932. Variety—Nabawa. 22 % Superphosphate—120lbs. per acre.

Rate of Seed.	Computed Yields per Acre.					Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1925–32.	Percentage Yields, 1925–32.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
60lbs.	20 32	19 20	19 52	19 44	17 44	19 26	105	16 14	103
45lbs.	19 20	19 4	19 4	18 40	16 32	18 32	100	15 45	100
90lbs.	19 28	20 0	20 16	18 0	17 52	19 7	103	16 7	102

RATE OF SEEDING EXPERIMENT.

Planted May 17th, 1932. Variety—S.H.J. 22 % Superphosphate—120lbs. per acre.

Rate of Seed.	Computed Yields per Acre.					Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1925–32.	Percentage Yields, 1925–32.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
60lbs.	17 28	18 0	19 20	19 12	19 12	18 38	101	13 28	103
45lbs.	17 12	17 44	19 4	18 56	19 12	18 26	100	13 5	100
90lbs.	18 32	19 52	20 24	20 0	19 44	19 42	107	13 50	106

Although this year's results are in favour of the heavier rates of seeding, more particularly with the sparse stooling varieties, the average results indicate that no appreciable advantage is gained by sowing over 45 lbs. of seed per acre.

Seasonal Planting Experiment.

The objects of the experiment are:—

1. To ascertain the most suitable month to plant the late, midseason, and early maturing varieties of wheat.
2. To determine the most prolific of each of the above types.

To meet the requirements of the experiment three seections were planted, viz.:—

(a) Section 1, planted in April, representing early planting;

(b) Section 2, planted in May, representing midseason planting;

(c) Section 3, planted in June, representing late planting.

Each section, planted in its respective month, was repeated five time, all plots being eventually harvested for grain.

The April sown plots germinated well, and were healthy throughout the season. The two early varieties gradually drew ahead and the two late varieties fell behind, particularly Sutton. There was little difference at any time between Nabawa and Bencubbin, any difference being in favour of Nabawa until spring. The variety Sutton did not grow so fast as Yandilla King until late spring. It then grew very rapidly indeed, and was considerably taller than the Yandilla King at maturity.

The two early varieties were obviously planted too early, and were in ear before the end of August.

The May sown plots germinated well, but made very little growth until spring, when growth was fairly rapid. There was very little difference between the plots until maturity, excepting that the two late varieties were obviously sown too late.

The June sown plots germinated rather slowly and irregularly. Growth was very slow indeed until spring, when all plots improved rapidly, and at maturity were only a little shorter in the straw than the May sown plots.

SEASONAL PLANTING EXPERIMENT.

APRIL PLANTING.

22 % Superphosphate—120lbs. per acre. Seed—45lbs. per acre

Variety.	Maturity.	Computed Yields per Acre.										Average Yields per acre.		Percentage Yields.	Percentage Yields, 1928–32.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	%
Yandilla King ...	Late ...	10	56	13	20	16	56	12	48	14	56	13	47	120	106
Nabawa ...	Midseason ...	9	12	10	48	11	20	12	0	14	0	11	28	100	100
Sutton	Late ...	10	16	16	24	12	0	12	16	16	16	13	26	117	117*
Bencubbin ..	Midseason ...	11	4	18	16	13	44	13	20	16	24	14	34	118	123†
Nabawa ...	Midseason ...	9	36	15	20	11	52	12	8	12	48	12	21	100	100
Gluyas Early ...	Early ...	10	56	12	32	10	40	11	44	11	44	11	31	93	95
Totadgin ...	Early ...	11	36	11	36	10	40	13	28	13	28	12	10	95	‡
Nabawa ...	Midseason ...	13	12	14	0	11	12	10	16	15	4	12	45	100	100

* 1931-32. † 1930 32 ‡ Planted 1932 only.

SEASONAL PLANTING EXPERIMENT.

MAY PLANTING.

22 % Superphosphate—120lbs. per acre. Seed—45lbs. per acre

Variety.	Maturity.	Computed Yields per Acre.										Average Yields per acre.		Percentage Yields.	Percentage Yields, 1928–32.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	%
Yandilla King ...	Late ...	10	56	7	12	8	0	15	4	14	56	11	14	72	88
Nabawa ...	Midseason ...	13	4	11	26	13	20	20	16	19	28	15	33	100	100
Sutton	Late ...	9	28	10	0	13	20	18	16	16	32	13	31	87	91*
Bencubbin ...	Midseason ...	14	0	13	12	16	48	22	16	20	16	17	18	114	114†
Nabawa ...	Midseason ...	12	0	11	12	15	20	18	32	18	40	15	9	100	100
Carrabin ...	Early ...	11	4	12	8	15	20	17	4	17	28	14	37	96	97
S.H.J.	Early ...	12	24	11	36	14	48	15	52	17	20	14	24	95	88
Nabawa ...	Midseason ...	12	32	10	16	15	12	19	12	18	16	15	6	100	100
Merredin ...	Early ...	11	28	9	4	14	24	16	32	13	12	12	56	86	87
Gluyas Early ...	Early ...	12	40	9	44	14	48	16	24	15	20	13	47	88	98
Nabawa ...	Midseason ...	13	28	9	36	18	0	19	12	18	24	15	44	100	100
Totadgin ...	Early ...	11	36	9	52	13	36	15	52	15	52	13	22	85	‡
Geeralying ...	Early ...	12	8	9	36	14	8	13	36	13	12	12	32	82	81
Nabawa ...	Midseason ...	12	24	10	0	19	44	16	40	17	20	15	14	100	100
Noongaar ...	Very early ...	10	32	8	8	13	4	12	32	15	44	12	0	79	65

* 1930-32. † 1931-32. ‡ Planted 1932 only.

SEASONAL PLANTING EXPERIMENT.

June Planting.

22 % Superphosphate—120lbs. per acre. Seed—45lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.										Average Yields per acre.		Percentage Yields.	Percentage Yields, 1928–32
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	%
Geeralying ...	Early ...	9	12	11	52	8	48	10	32	11	4	10	18	76	79*
Nabawa ...	Midseason ...	12	56	14	24	12	32	12	56	15	4	13	34	100	100
Bencubbin ...	Midseason ...	15	20	14	24	13	4	15	36	14	48	14	38	108	114†
Carrabin ...	Early ...	13	44	13	44	13	20	16	0	14	48	14	19	86	86
Nabawa ...	Midseason ...	16	0	16	48	15	44	17	44	17	28	16	45	100	100
S.H.J.	Early ...	16	8	14	8	14	0	16	32	14	56	15	9	91	84
Gluyas Early ...	Early ...	16	16	14	0	13	28	15	44	16	24	15	10	90	91
Nabawa ...	Midseason ...	17	12	17	4	15	44	17	12	16	56	16	50	100	100
Totadgin ...	Early ...	14	24	14	40	13	28	13	4	15	4	14	8	84	‡
Merredin ...	Early ...	17	4	15	20	15	28	16	0	16	32	16	5	94	89†
Nabawa ...	Midseason ...	18	48	17	12	16	8	17	52	15	52	17	10	100	100
Noongaar ...	Very Early...	14	24	15	20	18	32	16	56	12	56	15	38	91	78

* 1929-32. † 1930-32. ‡ Planted 1932 only.

These results demonstrate the suitability of late maturing varieties for early planting during April and midseason varieties for later planting on this class of soil.

Rate of Superphosphate Experiment.

The object of this experiment is to determine the most profitable amount of superphosphate to apply to the wheat crop.

Two sections, of 15 plots each, were planted. In No. 1 section the rates of superphosphate were 150 lbs., 225 lbs., and 300 lbs. per acre, and in No. 2, 75 lbs., 150 lbs., and no super, each being repeated five times.

Germination throughout the experiment was farily even, and growth robust, except where no superphosphate and 75 lbs. were used. The two latter each showed the effects of the excessive wet, but were considerably better than in former years, probably due to the residual effect of the superphosphate applied four years perviously.

There was little, if any, difference between the three heavy dressings at any time, growth and general appearance being excellent.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Planted on May 4th, 1932. Variety—Nabawa. Seed—45lbs. per acre.

Rate of 22 % Superphosphate.	Computed Yields per Acre.										Average Yields per acre.		Percentage Yields.	Average Yields per acre, 1929–32.		Percentage Yields, 1929–32.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	bus.	lb.	%
300lbs.	20	48	19	4	18	56	20	24	20	40	19	58	98	17	9	106
150lbs.	20	32	20	8	20	16	19	52	21	12	20	24	100	16	12	100
225lbs.	20	32	20	56	20	16	21	44	20	24	20	46	102	17	6	106

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Planted on May 4th, 1932. Variety—Nabawa. Seed—45lbs. per acre

Rate of 22 % Superphosphate.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre.	Percentage Yields.	Average Yields per acre. 1929-32.	Percentage Yields, 1929-32.
	bus. lb.	bus lb.	bus. lb.	bus. lb	bus. lb	bus. lb	%	bus. lb.	%
Nil	11 52	13 12	13 20	11 44	13 4	12 38	56	3 10	20
150lbs.	22 0	22 24	23 44	22 56	22 32	22 44	100	15 36	100
75lbs.	19 44	20 24	22 8	20 32	21 12	20 48	91	12 26	80

This year's results confirm those of former years, viz., that it is advantageous to apply considerably more than 75 lbs. of superphosphate on this class of land. Even at present low prices for wheat, an application of at least 120 lbs. per acre is warranted.

Potash Experiment.

The object of this experiment is to determine whether any advantage is derived from supplementing the application of superphosphate, with a potassic manure, for growing a wheat crop on light land.

Three fertilisers were used, and were applied as follows:—

Plot 1. 150 lbs. superphosphate plus 56 lbs. muriate of potash p.a.
Plot 2. 150 lbs. superphosphate (control).
Plot 3. 150 lbs. superphosphate plus 140 lbs. kainit per acre.

Germination and growth were fairly good throughout the experiment. There was no difference between plots at any time throughout the season, and at maturity the whole experiment was even and attractive.

POTASH EXPERIMENT.

Planted on 3rd May, 1932. Variety—Nabawa. Seed -45lbs. per acre. 22 % Superphosphate—150lbs. per acre.

Potash applied per Acre.	Computed Yields per Acre Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4	Sec. 5.	Average Yields per acre.	Percentage Yields.	Average Yields per acre. 1927-32.	Percentage Yields. 1927-32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Muriate of Potash, 56lbs.	22 8	21 28	20 32	20 16	21 12	21 7	95	16 40	98
No Potash	23 12	22 56	21 4	22 32	20 56	22 8	100	17 2	100
Kainit, 140lbs. ...	21 36	21 36	21 20	22 8	20 32	21 26	97	16 48	99

The results this year confirm those of former years, viz., yields are not increased by applying a potassic fertiliser to this class of soil.

Rhenania Phosphate Experiment.

The object of this experiment is to determine the value of Rhenania Phosphate for wheat growing as compared with superphosphate.

The usual three-plot system was used, and repeated five times.

No. 1 plot received 150 lbs. rhenania phosphate per acre.
No. 2 plot received 150 lbs. superphosphate per acre.
No 3 plot received 110 lbs. rhenania phosphate per care.

Germination was fairly good throughout the experiment, but as the season advanced the plots receiving rhenania phosphate fell behind the controls.

RHENANIA PHOSPHATE EXPERIMENT.

Planted on 5th May, 1932. Variety—Nabawa. Seed—45lbs. per acre.

Rate of Application of Phosphate per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1930–32.	Percentage Yields, 1930–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
150lbs. Rhenania Phosphate	15 4	17 44	18 40	17 9	85	14 13	75
150lbs. Superphosphate	17 12	19 44	23 36	20 11	100	18 58	100
110lbs. Rhenania Phosphate	14 48	14 50	17 44	15 49	78	12 50	68

Sections 4 and 5 discarded owing to interference by waterlogging.

These results confirm those of former years. viz., rhenania phosphate does not equal superphosphate as a means of supplying the wheat plant's requirements of phosphate.

Potash Nitrogen Experiment.

The object of this experiment is to determine the effect upon the wheat crop of—

(a) a nitrogenous fertiliser;

(b) a nitrogenous + a potassic fertiliser.

All plots received a dressing of 120 lbs. superphosphate per acre. No. 1 plot received, in addition, 1 cwt. sulphate of ammonia per acre, and No. 3 received the same dressing of sulphate of ammonia plus 56 lbs. of muriate of potash.

Germination was good and growth robust throughout the season. During the early part of the season the control plots were apparently not equal to the others, but late in the season the difference became less marked. At maturity the difference in favour of the plots receiving the sulphate of ammonia and muriate of potash was not very marked. Also there was no appreciable difference between the two sets of plots receiving the special fertilisers.

POTASH NITROGEN EXPERIMENT.

Planted on 4th May, 1932. Variety—Nabawa. 22 % Superphosphate—120lbs per acre.
Seed—45lbs. per acre.

Rate of Application of Fertiliser per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec 5.	Average Yields per acre.	Percentage Yields.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%
112lbs. Sulphate of Ammonia; 120lbs. Superphosphate	17 20	15 28	16 56	17 36	17 44	17 1	114
120lbs. Superphosphate	15 20	13 36	13 36	15 12	17 4	14 58	100
112lbs. Sulphate Ammonia; 56lbs. Muriate Potash; 120lbs. Superphosphate	18 32	15 12	16 16	17 28	18 24	17 10	115

Whilst these results are for one year only, and therefore cannot be regarded as conclusive, they show that increased yields can be expected by a heavy application of a nitrogenous fertiliser, but there is no further increase in yield when a potassic fertiliser is also used. The gain in yield, however, does not warrant the additional cost of special fertiliser.

Rate of Seeding Experiment—Oats.

As was the case for the rate of seeding with wheat, this was planted with a free and also a sparse stooling variety, Algerian representing the former and Burt's Early the latter.

Germination was satisfactory with both varieties, and throughout the season the growth was good. The light sowing was rather sparse in each case, but this became less apparent as the season advanced.

At maturity the light sowing of Burt's appeared rather thin and the straw coarse.

RATE OF SEEDING EXPERIMENT—OATS.

Planted on April 29th, 1932. Variety Algerian. 22 % Superphosphate—120lbs. per acre.

Rate of Seed.	Computed Yields per Acre.					Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1926–32.	Percentage Yields, 1926–32.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
45lbs.	15 16	14 24	13 32	15 32	14 16	14 32	102	14 14	108
30lbs.	16 8	13 8	14 0	15 16	13 32	14 21	100	13 11	100
60lbs.	14 24	14 24	16 24	15 32	15 16	15 16	106	14 28	111

RATE OF SEEDING EXPERIMENT—OATS.

Planted on May 2nd, 1932. Variety—Burt's Early. 22 % Superphosphate—120lbs. per acre.

Rate of Seed.	Computed Yields per Acre.					Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1926–32.	Percentage Yields, 1926–32.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus lb.	bus. lb.	bus. lb.	%	bus. lb.	
45lbs.	26 8	26 32	27 32	22 24	25 8	25 20	102	15 28	102
30lbs.	25 24	27 16	21 8	22 32	28 32	25 6	100	15 14	100
60lbs.	25 32	29 16	25 8	22 32	27 8	26 3	104	16 3	105

With both varieties the heaviest rate of seeding appears to advantage, but the average results over a number of years indicate that no appreciable advantage is gained by sowing over 45 lbs. of seed per acre.

PASTURE NURSERY PLOTS.

G. K. BARON-HAY,
Superintendent of Dairying.

H. G. ELLIOTT,
Agricultural Adviser.

Following on promising results obtained in single rows with a number of pasture plants of a perennial habit, it was thought desirable that farmers should be familiarised with these plants and be given an opportunity of obtaining seed if they should prove of economic value in their particular locality. With this object in view, therefore, a number of pasture nursery plots throughout the South-West were initiated, the Department of Agriculture acting in close co-operation with Cuming Smith & Mt. Lyell Farmers' Fertilisers, Ltd., who supplied the necessary fertiliser and assisted in supervision. The South-West portion of the State was divided into zones shown in the attached map, corresponding approximately with the zones in force for the Better Dairying Competition, and a brief resume is given below of the results in each zone.

Area—3/20ths of an acre, consisting of three plots each 1/20th acre in extent.

Cultivation.—Land ploughed and cultivated so as to form a consolidated seed bed with a fine even tilth to obtain an even germination, which is absolutely essential for success, the working of the land after germination of weed seeds being necessary prior to sowing the pasture seeds.

Seed.—The area of 3/20th acre was divided into three plots and sown as follows:—

(a)	Western Districts Perennial Rye Grass	20 lb.	per acre
	New Zealand White Clover	2 lb.	"
(b)	Akaroa Cocksfoot	20 lb.	"
	New Zealand White Clover	2 lb.	"
(c)	Phalaris tuberosa	10 lb.	"
	New Zealand White Clover	2 lb.	"

Fertiliser.—All plots were fertilised with superphosphate and ammonia No. 3 at the rate of 300 lb. per acre.

Sowing.—This was carried out immediately after the advent of the first general rains.

The seed and fertiliser were forwarded to the various farmers participating during the first week in April, and in the majority of cases were sown before the end of April.

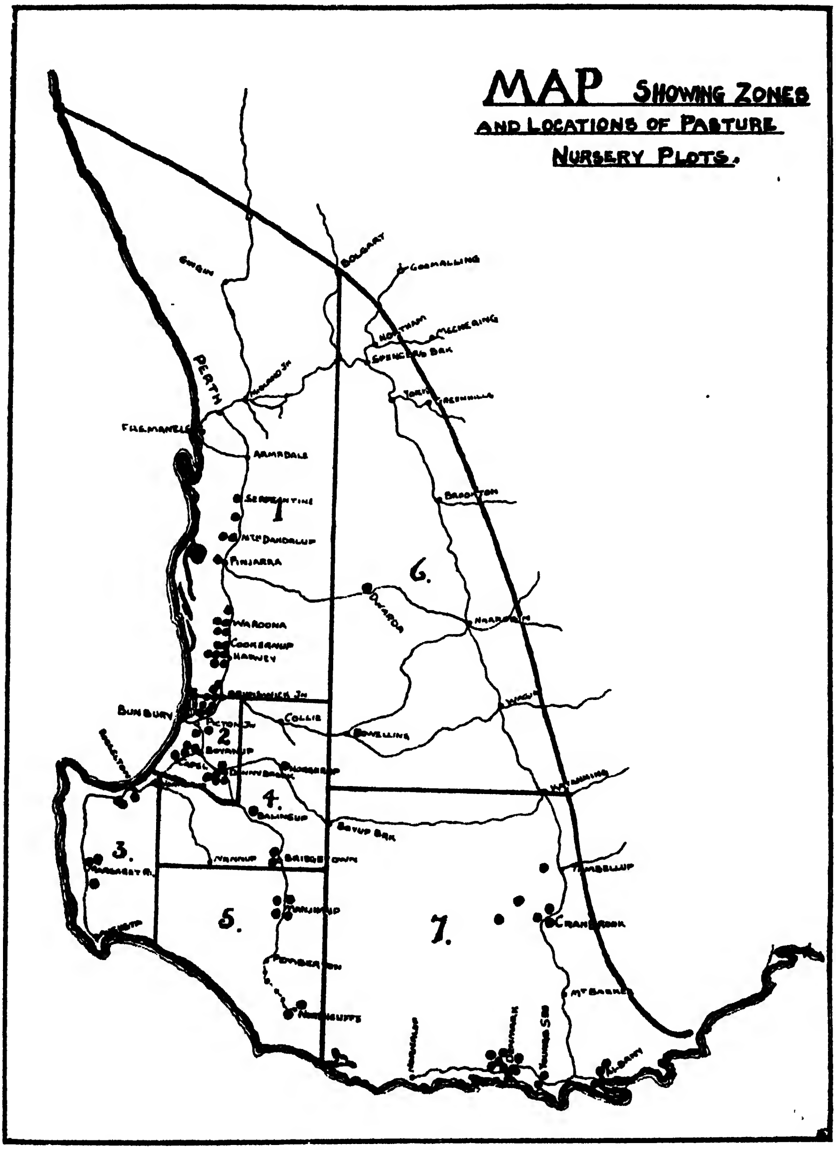
Throughout the year visits were made to the various centres for the purpose of inspection, and the results to date are given below:—

Zone 1. Rainfall 30—40 inches. Centre—*Waroona.*

In this zone there were 20 trial plots established on various classes of soil and under different conditions.

Germination.—On all sites the germination was excellent. The perennial rye grass from the beginning gave the best results, being followed by cocksfoot and *Phalaris tuberosa*. On the heavy classes of soil it was noticeable that the *Phalaris tuberosa* was growing much better than on the lighter types. White clover was

not successful on most plots, owing to the severity of the ravages of lucerne flea and red mite, but, where these pests were absent, or only limited, it grew and appears to be doing well.



Map showing zones and location.

Zone 2. Rainfall 40 inches. Centre—*Burekup.*

There were 18 plots established in this zone on a wide range of soils. As was the case in Zone 1, germination on nearly all the plots was excellent, but, on account of the severe check due to weed and insect infestation, all plots suffered more

or less. It, however, was noticeable that, with the grasses during the first season, the rye grass was the most promising, and in nearly every case the white clover failed owing to the effects of the red mite and lucerne flea.

The *Phalaris tuberosa* and cocksfoot made very slow growth in the earlier part of the season, but later the *Phalaris* was showing promise of being successful. It, however, remains to be seen which will be the most successful on the second year's trial.

Zone 3. Rainfall 30—40 inches. Centre—*Margaret River.*

In this zone only five plots were established, and from the results obtained the majority of them suffered severely from weed infestation, but the grasses generally were doing well, particularly the perennial rye grass and cocksfoot. White clover did not make any headway, being badly affected with red mite and lucerne flea.

Zone 4. Rainfall 30 inches. Centre—*Preston Valley.*

There were five plots established in this zone, the majority of which were free from weed infestation. Of the grasses the *Phalaris tuberosa* and cocksfoot were showing up better than the rye grass. The white clover in every case was a failure owing to the ravages of the pests, lucerne flea and red mite.

Zone 5. Rainfall 30—40 inches. Centre—*Manjimup.*

Of the five plots established in this zone, three gave very good results with white clover; the other two were failures. Of the grasses, the rye grass was most outstanding, followed by cocksfoot. The *Phalaris tuberosa* was not successful, this probably being due to the climatic conditions, as in every case germination was excellent but subsequent growth practically nil.

Zone 6. Rainfall 20—30 inches. Centre—*Narrogin.*

Only two plots were established in this zone, and the rye grass was the most successful, followed by the *Phalaris tuberosa.* In both cases the white clover failed.

Zone 7. Rainfall 20—40 inches. Centre—*Denmark.*

Seventeen plots were established throughout this zone, which has a wide variation in rainfall.

In the extreme southern coastal portion of this zone, which has 40 or over inches of rain per annum, the rye grass and cocksfoot were doing well, but the *Phalaris tuberosa* was more or less a failure, this being due probably to the extreme cold and wet conditions. The white clover was doing fairly well on most plots.

In the lower rainfall portion of the zone, the rye grass and *Phalaris tuberosa* were most outstanding, and in some places good stands of white clover have been obtained.

General.

The majority of the plots were sown on old pasture land without sufficient fallowing or cleaning to free it from weeds, consequently many of the experiments were in a very weedy condition, which made the competition too severe for the perennial plants, which are generally slower to come away after initial germination.

Insufficiency of preparation of the soil, combined with inadequate drainage and too deep planting of the seeds, all helped in retarding the natural development of a number of plots.

The white clover used in the mixture germinated well, but was severely checked and even completely killed in the early stages of growth on the majority of the plots by the severity of attack of both lucerne flea and red mite. Successful establishment of this clover was only obtained on those plots which were free or comparatively free from infestation of the above pests.

On the first year of trial, the perennial rye grass was undoubtedly the most promising, and, with the exception of the extreme southern portions of the State, the *Phalaris tuberosa* appeared to be established and no doubt will give good results next season. The cocksfoot has given fairly good results in all zones, with the exception, perhaps, of Zone 6, which has a lower rainfall and more severe summer conditions.

Further reports will be published at the conclusion of the second year's observations.

DROOPING-FLOWERED CLOVER

(*Trifolium cernuum*, Brot.).

T. C. DUNNE and C. A. GARDNER.

Drooping-flowered Clover is so named from the ultimately reflexed position of the individual flowers in the head, especially when in pod. Like most of our naturalised clovers, it is native to Southern Europe, especially Spain and the southern parts of France. Although such an important constituent of wet pastures in Western Australia, it is not so well known elsewhere, and although the clover is now finding favour in the east, practically the entire seed production for Australia comes from Western Australia. The specific name *cernuum* is from *cernuus*, a Latin word meaning "nodding" and referring to the hanging flowers of the species.

The clover is closely related to Cluster clover, but can readily be distinguished by its hollow stems, the reflexed flowers, and the presence of a long slender flower-stalk, whereas Cluster clover has compacted flower heads with no evident flower-stalk. Both clovers have pink flowers and small yellow seeds.

We are ignorant of the date that this clover appeared in Western Australia, also the circumstances of its appearance. There is little doubt its introduction, like so many other valuable plants, was accidental, and that while it has not made so much progress in the other States of Australia in which it is also naturalised, it found a fitting environment in the moist lands of South-Western Australia.

The species has been known to occur in Western Australia for over 20 years, and was first noticed by the late Mr. W. C. Grasby, who knew it in the Gingin district as "Gingin clover."

Description of Plant.

A hairless annual herb, with diffuse or ascending hollow stems, usually trailing for a length of from 12 to 20 inches, but frequently so dense in wet situations that it forms thick masses of up to 18 inches in height. Leaves on long slender leaf-stalks, elliptical or obovate-cuneate, thin and tender, minutely toothed, strongly veined, the stipules lanceolate, acute. Flower-stalks long and slender, bearing a head of small numerous flowers on short and thin pedicels. Calyx open at the throat, 10-nerved, erect or spreading when in flower, but drooping after flowering. Corolla pale pink, small. Standard notched at the apex, not much longer than the

calyx. Pod included in the calyx, 2-3-seeded. Seeds small, 1.3mm. long by about 1mm. wide, pale yellow, not lustrous, ovoid or sub-triangular-ovoid with a prominent radicle.

Drooping-flowered Clover has become one of the most important clovers in the wetter portions of the State. Like Subterranean Clover it makes a good stand on virgin soil, but it will thrive in situations which are not sufficiently well drained for Subterranean Clover. Under suitable conditions it is at least as prolific as Subterranean Clover, has less coarse stems, and is probably more palatable to stock. Moreover it shows considerable resistance to the ravages of Clover Springtail and Red-legged Earth Mite—two pests which have played such havoc in many established pastures of Subterranean Clover.

Chemical analyses show that the clover is highly nutritious, and similar to Subterranean Clover in composition. On top-dressed areas young pastures give values as high as 28 per cent. protein, and over 1.0 per cent. phosphorus, calculated on the weight of dried material. The composition of hay will vary from 12-18 per cent. protein, and .5-.8 per cent. phosphorus, depending upon the time of cutting.

Distribution.

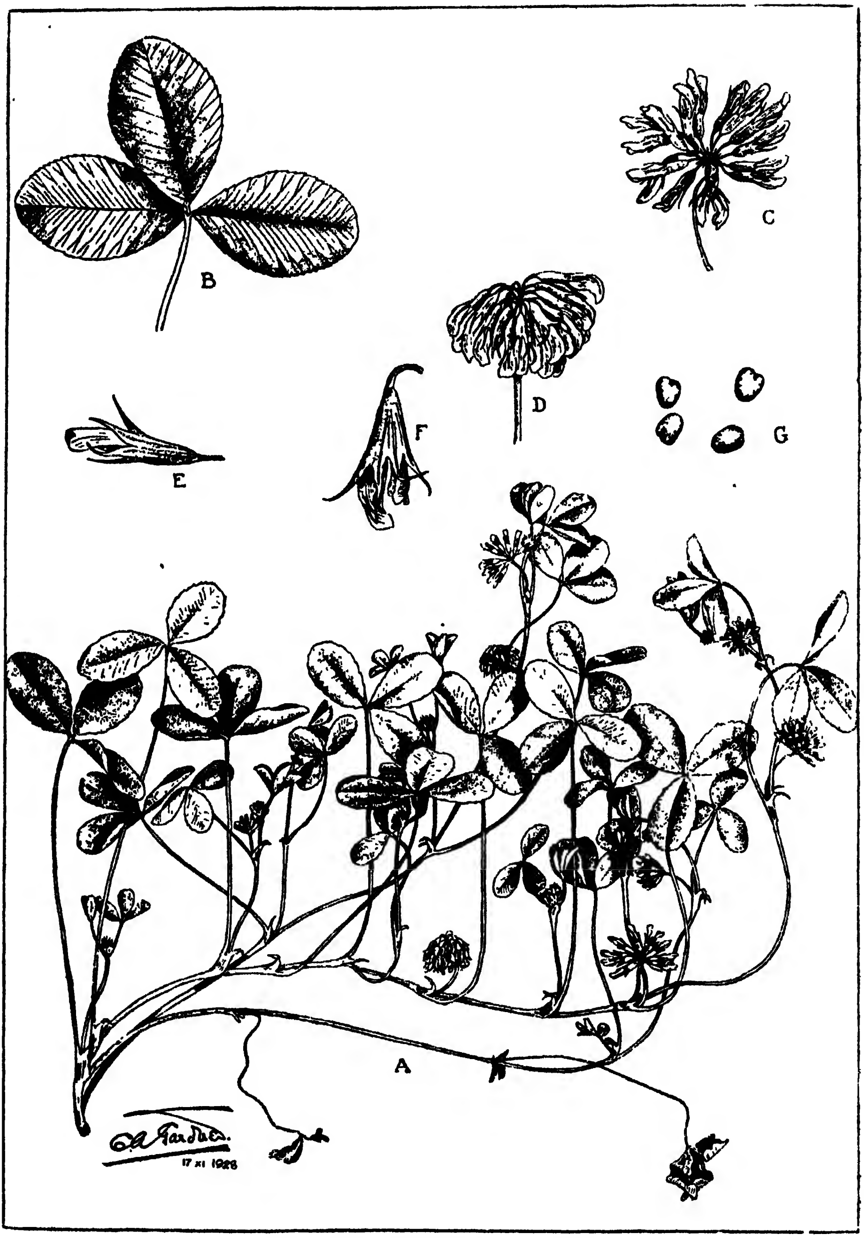
Drooping-flowered Clover will grow in a wide range of soil types, the limiting factors being lack of available soil moisture, and perhaps an excessive degree of acidity, which arrests the development of nitrogen-fixing bacteria. In soils which are moderately acid it succeeds better than Subterranean Clover. Available soil moisture is the principal requirement for this species. It prefers moist, or even wet situations, and is capable of withstanding long periods of inundation—at least three or four weeks. For this reason it is suitable for cultivation in the wettest soils of the South-West, such as periodic swamps, or land which retains its moisture until well into the late spring. The species is now naturalised as far north as Watheroo, and as far east as Kellerberrin and Quairading in moist situations. It is principally cultivated in the areas of the lower South-West southwards from Serpentine to the Vasse and Denmark districts, and also at Gingin.

Establishment and Seed.

Like Subterranean Clover, Drooping-flowered Clover may be successfully established on partially cleared virgin soil following a burn. Clean seed may be sown at the rate of 1-2 lbs. per acre with an application of from 1 to 2 cwts. of superphosphate. As with Subterranean Clover, the growth procured during the first year is usually poor, but with the multiplication of necessary bacteria, and of seed, a good stand is soon obtained.

This clover produces a very high percentage of hard seeds which do not germinate during the first season. A number of samples, tested from the 1931-1932 harvest averaged 6.0 per cent. germination, with a minimum of less than 1.0 per cent., and samples from the 1932-33 harvest have averaged about 2.0 per cent. It has been shown that by a scarifying process the germination of these seeds can be raised to 30 per cent. and, in some cases, 40 per cent. Since it is possible for all seed to be treated, farmers are urged to insist upon scarified seed for future sowings. This treatment is now being carried out by the Department of Agriculture.

Seed may be obtained by collecting matured clover before the seeds have been shed, and chaffing. This material may be put into bags for spreading on new areas. A cornsack of such "chaff" usually contains about 5 lbs. of seed. The method is not recommended where it can be avoided, since it helps to spread insect pests such as Red-legged Earth Mite and Clover Springtail.



DROOPING-FLOWERED CLOVER

(*Trifolium cernuum*, Brot.).

Explanation of Plate.

A.—Portion of Plant (half natural size) showing ascending habit.
B.—Leaf (natural size).
C.—Flowering head (natural size).
D.—Fruiting head (natural size).
E.—Flower × 4.
F.—Fruiting calyx × 4.
G.—Seeds × 4.

The clover sheds its seeds freely, and when the pods have opened, the seed lies on the ground forming a yellow covering to the soil. It is thus easily swept up, and may be cleaned.

A third method, employed by Messrs. Reading Brothers of the Vasse with considerable success, is the utilisation of cow droppings for sowing new areas. Droppings from cows fed on hay of this clover are collected from the yards and heaped. The fermentation of the heap acts on the hard seeds bringing about a high percentage germination. These droppings are spread over new land from a dray at the rate of about two loads per acre and a good stand is procured. By this method the necessary bacteria are probably also introduced.

Clean seed is obtained by cutting, chaffing and threshing.

Manuring.

At the time of sowing, superphosphate should be applied at the rate of from 1 to 2 cwts. per acre. This should be followed by a similar application each year after the first rains. A further dressing of 1 cwt. per acre during the spring is often advisable to procure maximum growth. Although the species thrives under moderately acid soil conditions, there are indications that an application of lime may make the clover more palatable to stock.

Management.

Drooping-flowered Clover may be grazed, or cut for hay or silage. As with Subterranean Clover it is best to cut early, since the protein and phosphorus contents fall rapidly with maturity. The best time is probably about the period of flowering. In the areas south of Bunbury it is often possible to secure two cuts per season—an early cut for silage, and a later cut for hay. Where this is proposed, the spring top-dressing with superphosphate should be particularly valuable.

After a few years of vigorous growth, clover sickness becomes apparent, and there is an increase in the poorer annual grass species. In such cases it is advisable to plough the soil for cropping (*e.g.*, oats, maize, peas, or potatoes). The area can during the following year be allowed to revert to pasture when a good stand of clover will be produced. In suitable areas ploughing may be followed by the introduction of perennial species of grasses and clovers for which the soil will have been well prepared by the annual clover.

POINTS IN PURCHASING SEEDS.

G. R. W. MEADLY, B.Sc., Agricultural Adviser.

Of all the purchases which a farmer is required to make, agricultural seeds probably show the largest range of variation in value. When we consider that they are also one of the most expensive recurring purchases, there is little need to stress the fact that great care must be taken when buying them. Cheap seeds are practically always unsatisfactory, but unfortunately the converse does not apply, and often an expensive line is actually of inferior quality. Although an indication of the quality may be obtained by an examination of the physical properties of the seeds, buying on general appearance alone certainly cannot be recommended. The only satisfactory method of deciding comparative values of seeds, and their suitability for agricultural purposes, is by a complete test of purity and germination.

Seeds imperfectly ripened frequently show the fact by wrinkled coats, lack of plumpness, and evidence of a green tinge, particularly in legumes. Variation in colour may be brought baout by a number of external factors. Dampness causes bleaching and mouldiness; bright and shiny seeds generally become dull with age; harvesting when unripe and storing before dry, or in moist places is usually associated with a darkening of the seeds and the presence of moulds. Less frequently an indication may be obtained by means of the smell, a mustiness suggesting dampness and growth of moulds.

In the case of a number of pasture grasses, *e.g.*, rye grass, cocksfoot, paspalum, where the actual seed remains enclosed within glumes, the bushel weight provides information regarding the value of the seed. Although an inferior grade of seed may be detected by making use of the foregoing facts, lines which do not show any of the incriminating features may still be of inferior quality. As stated before, the only means of detecting these lines is by making a test for purity and germination capacity.

When buying seeds a number of factors must be considered:—

(1) Genuineness.
(2) Suitability for district and soil conditions.
(3) Freedom from and resistance to disease.
(4) Place of origin.
(5) Purity.
(6) Germination.
(7) Quality.

A number of cases have come under my notice of seeds being sold under incorrect names. Until a few years ago this was probably the rule rather than the exception, with Toowoomba Canary Grass (*Phalaris tuberosa*) and Lotus Major (*L. uliginosus*). These are both perennials, which were largely replaced by inferior annuals, *Phalaris minor* and *Lotus hispidus* and *L. angustissimus* respectively. When one considers the discrepancy in value between the seed purported to be sold and that which was actually delivered, the need for care in this direction becomes evident. A more difficult position arises when strains are involved, for then in only very few cases is it possible to ascertain from the seed whether it is true to name. In such cases the farmer's only protection is the reliability of his seed merchant.

The suitability of the species or strain for the district and soil conditions should be given ample consideration: certain clovers and grasses thrive where others will merely exist or fail entirely, and many pasture plants have been condemned in a district owing to unsatisfactory results being produced by planting on unsuitable types of soils. Examples of two closely related species which give good results under very dissimilar conditions are Lotus major (*L. uliginosus*) and *L. corniculatus*. Whereas the former is more or less restricted to soils which retain considerable moisture close to the surface during the summer months, the latter produces summer growth under comparatively dry conditions. The recognition of strains within species is rapidly becoming of more importance, and the New Zealand system of certifying a number of these, such as Akaroa Cocksfoot, Hawke's Bay Perennial Rye Grass, and New Zealand White Clover, has done a lot for the general improvement of pastures. Although this Government certified seed is more expensive than ordinary lines, the increased production, palatability, and permanence, usually soon outweighs the difference in original outlay.

One of the many tasks which confront plant breeders is to evolve and fix strains which are disease resistant. This is more important in cereals than in fodder and pasture plants, and a considerable amount of work has been done in this State to produce and perpetuate strains of wheat which are resistant to diseases, particularly of fungal origin, such as "Rust" and "Flag Smut," *e.g.*, Nabawa for "Rust," and Nabawa, S.H.J., Bencubbin, Totadgin, Geeralying, etc., for "Flag Smut." Every advantage should be taken of the information which has been accumulated to obtain suitable but disease-resistant varieties, and at the same time endeavour to secure seed which is not infected either internally or superficially with disease growths, particularly fungi. Vegetable seeds, especially beans, peas, tomatoes, cabbages, and melons are likely to carry infection, and the fungus (*Peronospora sp.*) which causes the Downy Mildew of tobacco is also seed borne. Seed of Rye, Rye Grasses, and to a lesser extent a few other members of the grass family, sometimes contain black elongated bodies which are known as ergots. These are the resting bodies of a fungus, *Claviceps purpurea,* which take the place of some of the grains in the fruiting spikes. These ergots are poisonous, and the importation of any seed containing them is prohibited under the Commonwealth Quarantine Regulations.

When possible it is advisable to secure seed which has been grown under climatic and soil conditions similar to those prevailing where it is to be sown. Locally grown seed of good quality and strain is better adapted to local conditions than most seed which may be imported, and the matter of acclimatisation makes the origin of seed question worthy of consideration when buying.

Purity is one of the most important factors to be considered. The fitness of any sample for sowing depends primarily on the character and number of the foreign or extraneous seeds that it contains. If these foreign seeds are those of plants which will in any way seriously affect the crop that is to be grown, the sample must be considered quite unfit for the farmer to use. Weed seeds, besides giving rise to plants which will cause a reduction of the crop, may also affect the production capacity of the land for years, or even permanently reduce its value for agricultural purposes. An essential part of a seed analysis is the determination of the amount and kind of the weed seeds present, and the declaration of those which are noxious.

Besides extraneous seeds, commercial lines contain other impurities to a greater or lesser extent. These include broken and shrivelled seeds incapable of producing normal seedlings, stones and sand, empty glumes, or so-called husks, in the case of grasses, sticks and other organic matter. Although not so important as the seed impurities, this material is being paid for at the same rate as the seed desired, and is consequently a direct loss.

The other important factor which determines the fitness for sowing is the capacity and rate of germination and growth. A single satisfactory figure for all seeds cannot be suggested, owing to the large variation between such for different species. It is inadvisable to buy cheaply a low germinating line, for this feature is usually associated with low vigour. These defects, however, can be partially corrected by heavy sowings, whereas a line containing noxious weed seeds is a menace under any circumstances.

An unusual feature associated with certain seeds is their inability to germinate readily immediately after harvesting. This is particularly marked in the case of Paspalum (*Paspalum dilatatum*), the seeds of which appear to require a resting period prior to germination.

Many plants of the Pea family (*Papilionaceae*) produce a certain percentage of so-called "hard seeds." These seeds will not readily absorb water and ger-

minate, but remain hard for an indefinite period. Although of value under certain conditions for ensuring the permanence of a stand, for the first year of sowing a high hard seed content is usually a disadvantage. Locally the main plants producing this type of seed in any quantity are:—Subterranean Clover, Drooping Flowered Clover, Lupins, and Tangier Pea.

For the last few seasons Drooping Flowered Clover seed especially has contained a particularly high percentage of "hard seeds," averaging over 90 per cent. By means of a scarifying process, the germination of this small seeded clover has been increased considerably and for the current season, at least, all Drooping Flowered Clover seed should be treated before sowing.

The quality of seed includes such features as size and evenness. Large seeds usually give rise to vigorous and healthy plants, and, when considering such species as Subterranean Clover, usually contain a lower percentage of "hard seeds" than the smaller seeded lines. Plumpness and the absence of shrivelling are also factors which must be considered. The grading of seed to produce a uniform sample is of importance for, besides considerably improving the appearance of the line, the resulting crop is of a more even nature.

Farmers, generally speaking, should take more advantage of the Agricultural Seeds Act, a clause of which allows a purchaser to demand the purity, germination, and weed content of any line exposed for sale. Owing to the fact that often figures are given which are so low for purity and germination to be of no value at all, the following table is given as an indication of the figures for good lines of various agricultural seeds:—

Name of Seed	Purity by weight	*Weed Seeds not to exceed	Germination	Hard Seeds not to exceed.	†Actual Value
	%	%	%		%
Cocksfoot	90	0·2	80		72
Paspalum	75		45		34
Timothy	98	0·5	88		86
Sudan Grass	98	0·5	88		86
Yorkshire Fog	80	2·5	50		40
Italian Rye Grass M.D.	98	1·0	85		81
Perennial Rye Grass M.D.	98	1·0	80		78
Wimmera Rye Grass M.D.	96	1·0	88		84
Rape	99		96		95
Rib Grass	83	5·0	60		49
Medicago denticulata	90	0·5	65	A 5	60·5
Lucerne	98	0·1	88	A 7	88·0
Peas	98		98		96·0
Lotus corniculatus	99		90	B 3	90·0
L. hispidus	97	0·5	75	B 12	77·0
L. uliginosus (L. major)	90	1·5	85	B 8	79·0
Berseem Clover	99		95	A 2	95·0
Drooping Flowered Clover	85	5·0	35‡	B 65	45·0
Suckling Clover	90	2·0	65	B 25	66·0
Cluster Clover	86	3·0	30	B 60	43·0
Alsike Clover	97	0·5	90	A 8	89·5
Crimson Clover	99		80	B 2	80·0
Red Clover	99	0·5	88	B 7	90·5
White Clover	97	1·5	88	A 6	87·0
Subterranean Clover	98	0·8	75	B 15	81·0

* Weed seeds exclude other farm seeds. † Proportion of Hard Seeds included in Actual Value in the case of legumes, viz., half where Hard Seed figure preceded by A, a third where Hard Seed figure preceded by B. ‡ Figure which should be obtained by scarification.

The actual value is a very important figure and should be used when purchasing. It is derived by multiplying the purity figure by the germination figure and dividing by 100. One-half the "hard seeds" of large seeded legumes and one-third "hard seeds" of small seeded ones is added to the germination figure before this calculation is made.

After obtaining figures from the seed merchant it is advisable, before purchasing, to submit a sample of the seed to the Agricultural Department, where it will be tested for a small charge (rates shown below). A farmer has no redress after delivery has been accepted by him, and legal action can only be taken in respect of seeds, samples of which have been taken in the presence of the vendor, or his agent, by an officer of the Department.

Every farmer should avoid cheap seed, unless definitely proved of quality. Seeds bought at a low price usually prove an expensive purchase before good results are obtained, consequently buy to a standard and thus obtain good seed.

Tests are carried out by the Botanical Branch, Department of Agriculture, at the following charges:—

Purity, 5s.

Germination, 2s. 6d.

Purity and germination, 6s.

AN INEXPENSIVE WHEAT PICKLER.

By A. B. ADAMS. B.Sc. Agr.

An inexpensive but satisfactory pickler for pickling wheat with dry copper carbonate can be made by any handy man from an old petrol drum (40 gals.), one length of sawn jarrah 6 ft. x 4 in. x 4 in., and a length of round timber about 12 ft. x 9in. in diameter.

First, square holes, 4 inches on the sides, are cut in each end of the drum, as close to the edge as possible, but on opposite sides so that the 4 by 4 jarrah will pass diagonally through the drum, so giving it an eccentric motion when revolved.

Then another opening, about six inches on the sides, is cut on the side of the drum, as close to the end as possible, but at the opposite side of the end to the opening cut for the axle. If to make this opening, two diagonal cuts are made thus, the angular sections can be bent upwards and slightly outwards so leaving a square opening with a triangular section at each side. The triangular sections act as supports for a small filling hopper or funnel bolted or riveted to them. The funnel is made by riveting together four pieces of flat iron, say 7 inches wide at the bottom, 10 inches wide at the top by 8 inches deep; the extra inch is overlap or riveting. Then rivet or bolt the funnel to the turned up triangular pieces placing it inside them.

Pass the 4 x 4 through the drum but leave more exposed of the end to which the handle is to be fixed. It is better for the axle to be a tight fit.

Put a diagonal saw cut through the centre of the 12ft. x 9in. round and cut a half circle about 4in. in diameter in the bevelled end left by the saw cut in each section of round timber.

Place the round timber in holes sunk at a sufficient distance apart to allow the drum to revolve freely between them, with the cut surface of the bevels at the upper ends facing outwards. Now round off the end of the axle that projects the least and round off the other end in the right position to fit the support. Make any suitable handle and attach to the end of the axle with the greatest projection from the drum. Mount the drum on the supports.

Such a pickler will pickle about 2 bushels at a time; it will hold more than this but turning is difficult.

The way in which the drum is swung allows it to be emptied rapidly and completely; this is made easier by bolting small hook bolts to the drum to support a bag when emptying.

The diagram should make the description easier to follow.

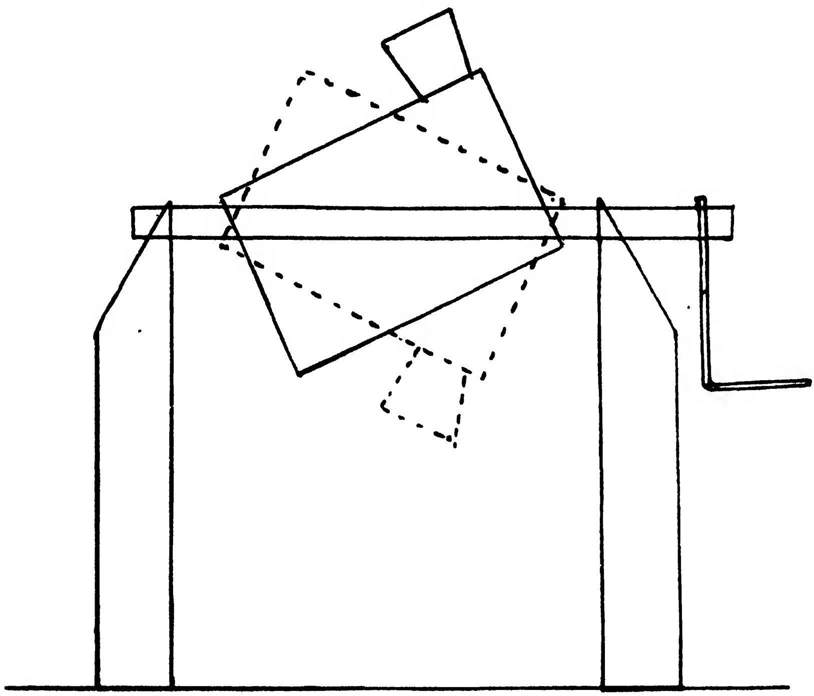


Diagram of Pickler made from old petrol drum. Solid lines show the filling, and dotted lines the emptying, position.

PEA WEEVIL

(*Bruchus pisorum*).

A Warning.

By L. J. NEWMAN, Government Entomologist.

In view of the rapid spread of the Pea Weevil, it is thought necessary to issue a further warning to growers and sellers of pea seed.

An appeal is being made to all concerned to co-operate in the necessary action for the suppression of this very destructive field pest.

Its control is not difficult, and those areas now free can be protected against its introduction.

A few careless growers or sellers of infested seed can be the medium of the rapid spread of this weevil.

It therefore behoves all growers to carefully examine the seed before buying, and, if indications of the presence of the weevil are found, to refuse purchase.

As a further precaution it would be wise to fumigate the seed.

A brief description of the various stages of the insect, together with remedial measures, is herein given.

If requiring fuller information, write for Leaflet No. 357.

Description of adult beetle: Black in colour, covered with a dense coating of fine brown hairs variegated with small patches of black and white hairs that form black and white spots on the thorax and wing covers.

The eggs: The adults appear in the crops in the spring and frequent the flowers and young pea pods. Their oval yellow eggs are laid on the exterior of the green pods. They hatch in about 16 to 21 days according to climatic conditions prevailing

The lava: The newly hatched larva or grub has six short feeble legs. It burrows straight down into the pod, boring a neat round hole into the developing young pea. Here the grub lives and grows. By the time the peas are ripe the larva is about one-sixteenth of an inch long and safely lodged in the interior of the pea. The completed larval stage, from the time of entering the pea to the pupal stage, takes about three months. Before pupating within the pea the grub eats away the substances of the pea at one end, leaving a circular semi-transparent mark which is typical of the presence of this weevil in the seed. Seeds showing this indication should be destroyed.

Pupa: This is the stage between the full-grown larva and adult beetle. This stage lasts for about three weeks to a month, when the adult beetle appears. These adults remain lodged inside the peas for an indefinite period, most of them remaining dormant until the following spring, when they issue to carry on the propagation of their species. There may be a partial second generation. Fortunately this weevil cannot propagate in the dry-stored peas, as do the true grain weevils in dry-stored wheat.

They do not do serious damage to the foliage or flowers, their destructive depredations being confined to the peas.

Some of the beetles do issue during January and February, but these hide away under suitable shelter until about July or August, when the main issue begin to come forth.

Remedial Measures.—It was only during last year that the Pea Weevil was recorded as a field pest in Western Australia. It is evident that the trouble has been introduced per medium of weevil-infested seed. It is by this means that it is spread from place to place. The beetles can fly well, but do not appear to travel long distances, being more or less local in their distribution.

The first line of attack is obvious, namely, to see that only weevil-free seed is used for sowing. The peas should be gathered as soon as possible after they are ready for stripping or threshing, and at once treated with some approved method for the destruction of the young developing larvae or grubs that may be present in the peas.

When the peas are just ripe, the grubs inside them are very small and have done little harm. If kept for a month the grubs will have greatly increased in size and eaten out large cavities in the peas. If kept for two months after being gathered, without treatment, the grubs will have matured, resulting in only the outer shell of the pea being left.

This species of Bruchidae cannot reproduce in dry peas as do the wheat weevils in wheat. Peas picked for use in the green do not suffer.

For the control of this pest the following suggestions are given:—

1. All peas kept for seed or dry food to be fumigated with carbon-di-sulphide as soon as gathered.
2. Sow crop as early as possible, so as to get peas off in the early spring.
3. Harvest the crop as much on the green side as is safe, rather than is usually done now, when they are left to get dead ripe.
4. The harvesting of the seed on the green side renders the pea straw of a much higher quality for food—the seed is heavier and its germinating powers are not affected.
5. Sow the next pea crop as far away from last year's as possible. In other words, practise rotation of crops.
6. A good purpose is served by allowing pigs to run in an infested field after taking off the crop. They will pick up the peas that have shed, including the infested ones.
7. Infested land should be thoroughly ploughed, seeing that the land is well turned over.
8. The fumigant recommended is carbon-di-sulphide. It must be applied as soon as the seed is gathered. The infesting grubs are then very small, and if at once killed their early presence in the peas is of little consequence. The seed should be placed in a gas-tight space, say a drum, tank, or room. The fumigant is used at the rate of 4 lb. to 1,000 cub. ft. of space, or, if used in a drum or tank, 1 fluid oz. (two tablespoonfuls) to every 200 lb. of seed.

The liquid may be poured on to pieces of old bagging or into shallow plates. The period of fumigation should not be less than 48 hours. The tops of drums or tanks may be covered with several wet bags to keep the gas from escaping.

In using the carbon-di-sulphide all naked lights must be kept away, as it is explosive and inflammable. Do not enter any room so fumigated until same has been thoroughly ventilated and all traces of the gas have disappeared. With ordinary care and intelligent application, this fumigant is perfectly safe to use.

The recommendations herewith, if carried out thoroughly, will control this weevil.

RELATIVE FOOD VALUES.

For the benefit of those farmers who find it necessary to purchase concentrated foodstuffs for their stock, the following table has been prepared showing the relative value of common supplements at current market rates:—

Relative Value of Concentrates, March, 1933.

Foodstuff.	Cost.	Cost per 100lbs.		Starch Equivalent per 100lbs.	Digestible Protein per 100lbs	Cost per lb. of Starch Equivalent.	Cost per lb. of Digestible Protein.
		s.	d.			d.	d.
Wheat	2s. 9d. per bushel of 60lbs. ...	4	7	72	9·0	0·76	6·1
Oats	1s. 9d. per bushel of 40lbs. ..	4	4½	60	7·0	0·88	7·5
Bran	£5 17s. 6d. per ton	5	3	50	9·0	1·26	7·0
Linseed Meal ..	14s. 6d. per 100lbs.	14	6	76	26·0	2·29	6·7
Meat Meal ...	7s. 9d. per bag of 50lbs. ...	15	6	90	60·0	2·07	3·1
Peas	5s. per bushel of 60lbs. ...	8	4	72	17·0	1·19	9·5

THE FERTILISER TRIALS AT HERDSMAN LAKE.

By J. C. PALMER, Potato Inspector.

A series of fertiliser trials was devised to ascertain the manure suitable for the growing of potatoes on the reclaimed land of Herdsman Lake. This reclaimed area is a calcareous clay. The surface is moist but solid, very dark grey in colour and contains numerous small shell of the Gasteropod type. The soil in general seemed to be composed of organic matter of a rubbery consistency, which possibly contains large amounts of partially decomposed cellulose and unhumified matter. The experimental area (approximately ¾ acre) was ploughed into lands and channelled suitable for watering by seepage. Delaware seed was used. Flat cultivation was followed, this being the general practice in the culture of all summer-grown crops.

The plots were planted on 17-18th October, 1932, and were dug from 19-29th January, 1933.

The weather during the earlier part of the growing period of the potatoes was fairly cool with some rain, which caused the potatoes to make rapid and vigorous growth. However, the latter end of the period was not so suitable, for there were many hot days accompanied with dry easterly winds. At this stage the Rutherglen Bug (*Nysius vinitor*) was very active, which probably caused a marked lowering of yield in the resultant crop. Also this season the Potato Moth (*Phthorimaoa operculella*) was very prevalent throughout the potato crops of the metropolitan area, and the experimental plots did not escape infestation from the ravages of this pest. Further, on the east side there were some indications of second growth, which seemed to prove that the watering had not been so regularly sustained as it might have been—a condition noted by Mr. Morgan, Senior Potato Inspector, on one of his visits, and certain suggestions were made by him to correct this, and to mitigate the damage being caused by insects to the crop.

Plots of 6/200 acre (approximately 1/33 acre) were used to demonstrate the different manurial treatments, so that soil variation might be overcome. These plots were sub-divided into 6 sub-plots, each of which was 1/200 acre. The weighings from each sub-plot were taken, and from these six weighings the Standard Experimental Error (Engledow and Yule) was calculated. The totals of the six weighings were taken as the completed plot yields, and are the totals shown in the tables, which follow subsequently in this report.

Set 1.

To determine whether a complete manure (4 cwt. sulphate of ammonia, 12 cwt. super, 2 cwt. sulphate of potash) is better than—

(a) no manure;

(b) super alone.

TABLE 1.

Standard Error of Experiment—4·88 lbs. per 1/200 acre plot.

Treatment in tons per acre.	Yield in lbs. per 6/200 acre.	Per cent.	Calculated yield in tons and cwts. per acre.
0–0–0	367	58	5–9
4–12–2	639	100	9–9
0–12–0	567	89	8–8

These figures show that—

(a) a complete manure is better than no manure;

(b) a complete manure is probably better than super alone.

Set 3.

To determine whether it is better to use a complete manure than—
(a) super and sulphate of ammonia;
(b) super and sulphate of potash.

TABLE 2.

Standard Error of Experiment 5·21 *lbs., per* 1/200 *acre plot.*

Treatment in tons per acre.	Yield in lbs. per 6/200 acre.	Per cent.	Calculated yield in tons and cwts. per acre.
4-12-0	713	101	10 12
4-12-2	709	100	10-10
0-12-2	576	81	8-11

These figures show that—
(a) no apparent difference between complete manure and one of 4-12-0;
(b) complete manure better than one of 0-12-2.

Set 4.

To determine whether it is better to use 0-4-12 cwts. of super plus sulphate of ammonia and sulphate of potash—

TABLE 3.

Standard Error of Experiment –8·51 *lbs. per* 1/200 *acre plot.*

Treatment in tons per acre.	Yield in lbs. per 6/200 acre.	Per cent.	Calculated yield in tons and cwts. per acre.
4-0-2	320	44	4-14
4 12-2	710	100	10-10
4-4-2	565	79	8-8

These figures show that—
(a) a complete manure is better than a mixture of 4-0-2;
(b) a complete manure is better than a mixture of 4-4-2.

Set 6.

To determine whether it is better to use 2-4-6 cwts. of sulphate of ammonia per acre—

TABLE 4.

Standard Error of Experiment 4·53 *lbs. per* 1/200 *acre plot.*

Treatment in tons per acre.	Yield in lbs. per 6/200 acre.	Per cent.	Calculated yield in tons and cwts. per acre.
2-12-2	657	99	9-15
4-12-2	664	100	9-17
6-12-2	630	96	9-8

These figures show that there is no real apparent difference between using 2-4-6 cwts. of sulphate of ammonia per acre.

BLUESTONE TRIALS.

An experiment was also made to test the advantage of using gypsum and a mixture of gypsum and bluestone; these products added to a complete manure against the complete fertiliser alone—

TABLE 5.

Standard Error of Experiment—4·57 lbs. per 1/200 acre plot.

Treatment in tons per acre.	Yield in lbs per 6/200 acre.	Per cent.	Calculated yield in tons and cwts. per acre.
4–12–2 + 56lbs. gypsum	674	99	10–0
4–12–2	681	100	10–2
4–12–2 + 561lbs. gypsum + 14lbs. bluestone ...	733	108	10–18

These figures suggest that no benefit was derived by adding gypsum to a complete manure, but that the addition of 14 lbs. of bluestone to the complete manure and the gypsum gave an increased yield.

CONCLUSIONS.

1. The most satisfactory fertiliser from these experiments on virgin soil at Herdsman Lake (a grey calcareous clay) consists in a mixture of ammonium sulphate and superphosphate. A mixture of 2 cwt. of sulphate of ammonia and 12 cwt. of super seems to be the most economical.

2. Use of potassic fertilisers in the complete manure 4-12-2 did not influence the yield as compared with super and sulphate of ammonia.

3. In absence of sulphate of ammonia the sulphate of potash caused a significant depression of yield as compared with a complete manure. This may be due to some physical effect of the manure on the young plants.

4. Copper sulphate in addition to the complete manure gave an increased yield, which may be significant.

5. Scab was prevalent throughout the plots.

BRANDING THE WOOL BALES.

By H. McCALLUM, Sheep and Wool Inspector, and W. McC. JOHNSON, Cadet.

Wool correctly described and the bales neatly branded are essential to give buyers confidence in the clips catalogued.

A general inspection of the wool displayed by the brokers reveals many instances of deplorable carelessness on the part of the wool-growers.

The bale should be clearly and distinctly branded with—

1. The name of the property or owner's initials.
2. The letters denoting the description of the contents, and
3. The bale number.

Complicated wool-brands, especially those which contain characters or shapes not easily decipherable, entail extra work at the Wool Stores. The use of horse and cattle brands on the bales are not necessary, and often the bales show too many brands.

For neat and accurate branding a well-cut stencil is essential. These can be made on the farm, or purchased at a small cost. Uniformity in branding the bales should be aimed for, and the appearance of the clip on the floors is greatly enhanced if the marks on each bale correspond with regard to placing and spacing. Many clips seen on the floors show very irregular and untidy branding of the bales, stencils not having been used, and in some instances the marks are even put on with charcoal.

The use of stencils made for fruit cases in unsatisfactory, as the resulting brands are too small for the wool bales.

Apart from a pleasing appearance, well-branded bales have a most important value. Buyers who find a clip suitable to their requirements and true to the description on the bale will record that particular clip and look out for it in future sales, thus establishing a ready market for the wool of the careful grower.

The departmental Bulletin, No. 154, gives full information regarding correct branding and is very clearly illustrated.

MAIZE FERTILISER TRIALS—1932-33.

G. K. BARON-HAY,
Superintendent of Dairying.

A number of fertiliser trials were carried out throughout the South-West during the season 1932-33, the cost being borne jointly by Cuming, Smith and Mt. Lyell Farmers' Fertilisers, Ltd., and the Department of Agriculture. The object of the experiments was to provide information regarding the most economical fertilisers to use for the growing of maize, the soils chosen in each case being those representative of the district.

The fertilisers used were—

1. Superphosphate 4 cwts. per acre.
2. Superphosphate 4 cwts, per acre + Sulph. ammonia 2 cwts. per acre.
3. Superphosphate 4 cwts. per acre + Sulph. ammonia 2 cwts. per acre. + Sulph. potash 1 cwt. per acre.
4. Superphosphate 4 cwts. per acre + Sulph. potash 1 cwt. per acre.

Each plot was ⅛ acre and each treatment replicated three times for the purpose of accuracy, taking into consideration any variation in soil conditions.

A. J. Kemp, Wonnerup:

At Wonnerup a trial was conducted by Dairy Instructor Giles on the property of Mr. Kemp.

Soil.—The type selected was a grey sandy loam originally timbered with red gum and jarrah, badly drained, and not previously cropped.

Preparation.—The land was ploughed with a disc and harrowed in the autumn. This was cross-ploughed to a depth of four inches at the time of seeding.

Method of Sowing.—The fertiliser was applied in every third furrow and covered lightly with soil prior to seeding.

Depth of Seeding.—Approximately three inches.

Rate of Seeding.—28 lbs. per acre.

Cultivation after Seeding.—Plot twice harrowed after planting, followed by a rumbler in order to level off, and the whole again harrowed and levelled off when seeding was completed.

Variety.—"Hickory King."

Date of Seeding.- 7th to 14th November.

Germination.—Fair, 75 per cent. strike.

After Cultivation.—26th November.

Distance between Rows.—24 inches.

Results of Fertiliser Trial on Maize for Fodder with A. J. Kemp, Wonnerup.

Season 1933.

On New Land. *Planted* 10*th November*, 1932.

Plot No.	Fertiliser per acre.	Cost of fertiliser per acre plus freight.	Average yield per acre.	Worth of yield per acre at 15s. per ton (Dairy Branch figure).	Worth of Crop per acre, less fertiliser cost and freight.	Percentage yield.
		£ s. d.	T. C. Q. L.	£ s. d.	£ s. d	
1, 5, 9 (Controls)	Super.—4 cwt. ...	1 0 0	3 14 2 2	2 15 10	1 15 10	100
2, 6, 10	Super.—4 cwt.; Sulphate of Ammonia, 2 cwt.	2 6 2	12 6 1 8	9 4 8	6 18 6	330
3, 7, 11	Super.—4 cwt.; Sulphate of Ammonia, 2 cwt.; Sulphate of Potash, 1 cwt.	3 7 7	13 1 1 22	9 16 1	6 8 8	351
4, 8, 12	Super.—4 cwt.; Sulphate of Potash, 1 cwt.	2 1 5	7 2 2 12	5 6 11	3 5 6	191

NOTE.—Fertiliser freight—Picton to Wonnerup — 6d. per cwt.
Superphosphate ... ... at £4 10s. per ton.
Sulphate of Ammonia ... at £12 12s. „
Sulphate of Potash ... at £20 18s. 6d. „

Weights were taken on 3rd February, 94 days after seeding. All plots were in full tassel and commencing to cob.

Average Heights—

Control—4½ ft. Drying off rapidly.

Nos. 2, 6, 10—7½-8 ft. Excellent condition, succulent.

Nos. 3, 7, 11—7½ ft. Excellent condition, succulent.

Nos. 4, 8, 12—5 ft. Colour poor, less succulent.

L. Stiles, Group 52, *Vasse Siding:*

Supervised by Dairy Instructor Giles.

Soil.—Red sandy loam originally carrying red gum and jarrah.

Drainage.—Good.

Preparation.—Plot was planted three years ago with maize, clover established over period intervening prior to preparation for trial plots. The first ploughing was carried out on September 30th to a depth of six inches, harrowed on October 15th, and reploughed to a depth of four inches on October 28th and harrowed the following day.

Method of Planting.—Drills ploughed four inches deep and 36 inches apart. Fertiliser applied in bottom of furrow and lightly covered with soil. Planting followed.

Rate of Seeding.—20 lbs. per acre.

Variety.—"Hickory King."

Date Planted.—7th to 10th November, and harrowed again on 13th November. Cultivated between rows on 10th December.

Germination.—Fair. Approximately 80 per cent.

Weights taken on 13th February, 97 days after seeding.

Results of Fertiliser Trial on Maize for Fodder with L. Stiles, Group 52, Vasse Siding—Season 1933.

On Sub. Clover Land. *Planted 10th November, 1932.*

Plot No.	Fertiliser per acre.	Cost of fertiliser per acre plus freight.	Average yield per acre	Worth of yield per acre at 15s. per ton (Dairy Branch figure).	Worth of Crop per acre, less fertiliser and freight costs.	Percentage yield.
		£ s. d.	T. C. Q. L.	£ s. d.	£ s. d.	
1, [illegible] 9 (Cont[illegible])	Super.—4 cwt. ...	1 0 6	9 3 1 15	6 17 6	5 17 0	100
2, 6, 10	Super.—4 cwt.; Sulphate of Ammonia, 2 cwt.	2 6 11	11 3 2 21	8 7 9	6 0 10	122
3, 7, 11	Super.—4 cwt.; Sulphate of Ammonia, 2 cwt.; Sulphate of Potash, 1 cwt	3 8 5	10 10 0 20	7 17 7	4 9 2	115
4, 8, 12	Super.—4 cwt.; Sulphate of Potash, 1 cwt	2 2 0	8 9 1 10	6 7 0	4 5 0	92

NOTE.—Fertiliser freight—Picton to Vasse Siding = 7½d. per cwt.

Superphosphate ...	... at £4 10s.	per ton
Sulphate of Ammonia	... at £12 12s.	„
Sulphate of Potash	... at £20 18s. 6d.	„

This crop was permitted to dry off considerably before weights were taken. Much heavier yields might have been obtained a week earlier.

Bee Bros., Keysbrook:

Supervised by Agricultural Adviser H. G. Elliott.

Soil.—Brown sandy loam with clay underlying.

Drainage.—Fair.

Preparation.—Land was planted the two previous years with maize. The soil was prepared by spring planting. The fertiliser was applied in the furrow at planting, being covered ligthly by soil before seeding.

Germination.—Poor. 65 per cent. strike.

Distance between Rows.—32 inches.

Weights taken on 19th January.

Results of Fertiliser Trial on Maize for Fodder with Bee Bros., Keysbrook—Season 1933.

On Old Land. *Planted* 8th *November*, 1932.

Plot No.	Fertiliser per acre.	Cost of fertiliser per acre plus freight.			Average yield per acre.				Worth of yield per acre at 15s. per ton (Dairy Branch figure).			Worth of Crop per acre, less fertiliser and freight costs.			Percentage yield.
		£	s.	d.	T.	C.	Q.	L.	£	s.	d.	£	s.	d.	
1, 5, 9 (Controls)	Super.—4 cwt.	1	0	6	10	10	2	26	7	18	1	6	17	7	100
2, 6, 10	Super.—4 cwt.; Sulphate of Ammonia, 2 cwt.	2	6	11	13	10	0	13	10	2	7	7	15	8	128
3, 7, 11	Super.—4 cwt.; Sulphate of Ammonia, 2 cwt.; Sulphate of Potash, 1 cwt.	3	8	5	14	1	0	7	10	10	9	7	2	4	133
4, 8, 12	Super.—4 cwt.; Sulphate of Potash, 1 cwt.	2	2	0	12	1	1	26	9	1	1	6	19	1	115

NOTE.—Fertiliser freight—North Fremantle to Keysbrook = 7½d. per cwt.

Superphosphate ... ... £4 10s. per ton.
Sulphate of Ammonia ... at £12 12s. ,,
Sulphate of Potash ... at £20 18s. 6d. ,,

This crop suffered severely from the effects of the Rutherglen bug. The general growth was very uneven owing to the variation in the soil. All plots were in the cobbing stage at time of weighing.

General Observations—

Control—Average height 5 ft. Yellow green colour.

2, 6, 10—Average height 6 ft. Green. Succulent.

3, 7, 11—Average height 6½ ft. Deep green. Succulent.

4, 8, 12—Average height 5½ ft. Slight yellow green colour.

On averaging all the plots the following figures were obtained:—

Fertiliser per acre.	Cost of fertiliser per acre, plus freight.			Average Yield per acre.				Worth of Yield per acre at 15s. per ton.			Worth of Crop per acre, less fertiliser and freight costs.			Percentage Yield.
	£	s.	d.	T.	C.	Q.	L.	£	s.	d.	£	s.	d.	
Superphosphate, 4 cwt. ...	1	0	4	7	16	0	24	5	17	2	4	16	8	100
Superphosphate, 4 cwt.; Sulphate of Ammonia, 2 cwt.	2	6	8	12	6	2	24	9	5	0	6	18	4	152
Superphosphate, 4 cwt.; Sulphate of Ammonia, 2 cwt.; Sulphate of Potash, 1 cwt.	3	8	2	12	10	3	16	9	8	5	6	0	0	161
Superphosphate 4 cwt.; Sulphate of Potash, 1 cwt.	2	1	10	9	4	1	26	6	18	4	4	16	6	118

The following results were obtained from the first year's experiments:—

1. A nitrogenous fertiliser in conjunction with superphosphate is essential for the purpose of growing maize successfully, and results in reduced cost of production.
2. Potash in conjunction with superphosphate or superphosphate and ammonia increases the yields, but is not economical and appears unnecessary.
3. Superphosphate alone does not give economical results, but must be used to supply phosphoric acid.
4. Superphosphate alone gives better results on old cultivated land than on new land, which is generally deficient in nitrogen.
5. Well worked and an early prepared soil is essential for maize; for preference it should be well drained and contain humus.

FIELD EXPERIMENTS WITH WHEAT AND OATS, 1932.

SALMON GUMS EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
L. G. SEINOR, Farm Manager.

The following are the monthly rainfalls as recorded at the farm during 1932, together with the averages for the seven years the farm has been established.

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period							Nov.	Dec.	Total for Year.
					May.	June.	July.	Aug.	Sept	Oct.	Total.			
1932 ...	49	*Nil*	90	87	78	104	144	210	79	330	1,004	26	49	1,307
Av. 7 yrs.	31	51	158	93	142	137	145	208	79	133	844	47	61	1,285

The total rainfall for the year was 1,307 points, being slightly over the average, while that for the growing period was 1,004 points, 160 points above the average for the same period.

Very little rain, however, fell early in the year. The latter half of April and almost the whole of May were unusually deficient of rain. The only falls of value registered during the month of May fell on the 29th and 31st, when 37 and 36 points respectively were recorded.

The delayed seeding rains were too late to enable the fallowed land to be planted in the desired wet condition. The germination of the early sown crops was also considerably retarded.

The rainfall from June to September was about the average but particularly heavy rains were experienced during October. These, although late, proved of considerable value, particularly to the later maturing varieties. A number of frosts were recorded during the growing period, but little or no damage to the grain occurred.

The land on which the experiments were conducted carried originally silver bark and mallee, which had been rolled down during 1926. Previous to 1932 it had grown two crops, each on fallow. During June, 1931, it was ploughed with a disc cultivating plough to a depth of 3-4 inches. It was disced two inches deep towards the end of September and again in April. The land was rigid tyne-cultivated early in May and springtyne-cultivated immediately prior to planting.

Time of Seeding Experiment

The object of this experiment is to determine the most suitable time for planting the wheat crop Two varieties were used, the midseason variety Nabawa being sown in mid-April, May and June, and the early variety Gluyas Early in mid-May, June and July The results are tabulated below·—

TIME OF SEEDING EXPERIMENT

Variety—Nabawa Seed—45lbs per acre 22 % Superphosphate—112lbs per acre

Time of Planting	Computed Yields per Acre Sec 1		Sec 2		Sec 3		Sec 4		Sec 5		Average Yields per acre 1932		Percentage Yields 1932	Average Yields per acre 1928–32		Percentage Yields 1928 32
	bus	lb	bus	lb	bus	lb	bus	lb	bus	lb	bus	lb		bus	lb	
April	17	44	18	16	19	16	17	20	17	52	17	28	102	15	9	105
May	16	56	17	44	17	6	17	[illegible]	17	36	17	30	100	14	23	100
June	15	36	14	40	14	40	14	8	15	44	14	58	86	9	33	66

TIME OF SEEDING EXPERIMENT

Variety—Gluyas Early Seed 45lbs per acre 22 Superphosphate 112lbs per acre

Time of Planting	Computed Yields per Acre Sec 1		Sec 2		Sec 3		Sec 4		Sec 5		Average Yields per acre 1932		Percentage Yields 1932	Average Yields per acre 1928–32		Percentage Yields 1928 32
	bus	lb	bus	lb	bus	lb	bus	lb	bus	lb	bus	lb		bus	lb	
16th June	18	16	17	28	20	40	22	8	22	56	20	18	88	13	14	81
16th May	22	48	21	20	21	2	25	4	24	16	23	4	100	16	18	100
17th July	16	16	17	12	17	28	18	16	18	24	17	31	76	10	45	66

The late seeding and, in consequence, the delayed germination of the April any May plantings, have no doubt affected the results for this year, but they again demonstrate that the yields of both early and midseason varieties are considerably reduced when the crop is planted later than the month of May

The average yields for the period the experiment has been conducted—1928-32—show that a midseason variety gives the best result when planted in April and an early variety when planted in May

Rate of Application of Superphosphate Experiment

For the purpose of conducting this experiment, it is divided into two sections in order to ascertain the effect of applying the following amounts of superphosphate to the wheat crop —

Section 1—

300 lb. per acre,
150 lb per acre (Control),
225 lb per acre

Section 2—

No superphosphate,
150 lb. per acre (Control);
75 lb per acre.

The results are tabulated below:—

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Variety—Gluyas Early. Planted on 17th May, 1932. Seed—45lbs. per acre.

Rate of Application of 22 per cent. Superphosphate per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1929–32.	Percentage Yields, 1929–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
300lb	15 36	23 44	24 40	23 52	24 24	22 27	91	17 15	100
150lb.	23 20	25 36	24 56	24 8	24 40	24 32	100	17 15	100
225lb.	23 20	24 40	23 28	23 44	24 56	24 2	98	17 40	103

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Variety—Gluyas Early. Planted on 17th May, 1932. Seed—45lbs. per acre.

Rate of Application of 22 per cent. Superphosphate per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1929–32.	Percentage Yields, 1929–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
No Superphosphate ...	6 40	7 36	8 8	7 20	6 48	7 18	30	7 12	42
150lb.	23 36	24 0	24 40	24 8	24 24	24 10	100	17 19	100
75lb.	21 36	23 20	23 36	22 16	23 36	22 53	95	16 24	95

The results again indicate that the yields are increased when the heavier rates of superphosphate are applied. Under present economic conditions, however, the optimum rate is somewhat above 75 lb. per acre, probably in the vicinity of 100 lb.

Potash-Nitrogen Experiment.

The object of this experiment is to determine the effect upon the yield of the wheat crop by the application of—

(a) a nitrogenous fertiliser;

(b) a nitrogenous + a potassic fertiliser.

Sulphate of ammonia and muriate of potash were used and were applied to the respective plots separately a few days prior to seeding. The results obtained are given below:—

POTASH NITROGEN EXPERIMENT.

Variety—Gluyas Early. Planted on 17th May, 1932. Seed—45lbs per acre.

Rate of Application of Fertiliser per acre.	Computed Yields per acre. Sec. 1.	Sec. 2.	Sec. 3	Sec. 4.	Sec. 5.	Average Yields per acre.	Percentage Yields.
	bus. lb	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	
112lb. Sulphate of Ammonia; 112lb. Superphosphate	22 40	23 12	23 4	23 20	23 20	23 7	98
112lb. Superphosphate	22 0	23 20	24 8	23 4	25 4	23 31	100
112lb. Sulphate of Ammonia; 112lb. Superphosphate; 56lb. Muriate of Potash	20 56	20 48	21 52	24 24	23 36	22 19	95

These results, which are for one year only and hence cannot be taken as conclusive, show that no increase in yield is obtained when either a nitrogenous fertiliser or a nitrogenous and a potassic fertiliser is applied in addition to superphosphate.

EXPERIMENTS ON "KOPI" SOILS.

Owing to the unsatisfactory crops of wheat generally obtained from the so-called "kopi" soil in the Salmon Gums area, it was decided to conduct experiments with a view to obtaining definite information regarding crop response on this class of soil.

The Salmon Gums "kopi" is described as a light-grey highly calcareous soil. It is fairly powdery and resembles grey morrel soil of the eastern wheat belt. With working, "kopi" soil tends to compact down a little.

The vegetation includes giant mallee timber, this being a variety of *Eucalyptus oleosa* and is a member of the red morrel family.

The following experiments were conducted:—

Seasonal Planting Trial with Wheat;
Seasonal Planting Trial with Oats;
Fodder Trial;
Manurial Trial.

The land on which the experiment was planted originally carried morrel, black mallee and tea-tree. It was cleared in 1924. In June, 1930, it was ploughed and the mulch was maintained throughout the year. In June, 1931, it was re-ploughed with a disc implement 3in.-4in. deep and cross-ploughed with the same implement in September. It was springtyne cultivated in October and again after rain in April.

Seasonal Planting Experiment—Wheat.

The object of this trial is to determine the most suitable time to plant the very early, early and mid-season maturing varieties of wheat.

Accordingly the standard varieties Noongaar, Gluyas Early and Nabawa were each planted in their respective plots during the months of April and May. However, owing to the scanty rainfall during April and the early part of May, the seed planted in both sections did not germinate until early June. The results obtained are shown hereunder:—

SEASONAL PLANTING EXPERIMENT—WHEAT.

APRIL PLANTING.

Planted on 25th April, 1932. Seed—45lbs. per acre. 22 % Superphosphate—112lbs. per acre.

Variety.	Computed Yields per Acre.					Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1931-32.	Percentage Yields, 1931-32.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Noongaar	13 20	12 48	11 44	12 0	11 28	12 16	91	9 21	93
Nabawa	13 36	13 52	14 40	12 48	12 16	13 26	100	10 4	100
Gluyas Early	15 28	16 0	14 56	14 24	14 8	14 59	112	10 43	106

SEASONAL PLANTING EXPERIMENT—WHEAT.

MAY PLANTING.

Planted on 12th May, 1932. Seed—45lbs. per acre. 22 % Superphosphate—112lbs per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1931–32.	Percentage Yields, 1931–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Noongaar	8 48	8 16	7 12	7 28	6 56	7 44	87	6 16	89
Nabawa	9 4	9 20	10 8	8 16	7 44	8 54	100	6 59	100
Gluyas Early	10 56	11 28	10 24	9 52	9 36	10 27	117	7 37	109

These results, despite the fact that both plantings germinated at the same time, indicate the advantage of the early planting of wheat on this class of soil, even though the varieties may vary in the time of maturity.

Seasonal Planting Experiment—Oats.

The object of this experiment is to determine the most suitable month in which to plant the early, midseason and late maturing varieties of oats on this class of soil. Accordingly the standard varieties Mulga, Guyra and Algerian were each planted in their respective plots during the months of April and May.

The results obtained are shown hereunder:—

SEASONAL PLANTING EXPERIMENT—OATS.

APRIL PLANTING.

Planted on 25th April, 1932. Seed—40lbs. per acre. 22 % Superphosphate—112lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1931–32.	Percentage Yields, 1931–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Mulga	9 24	9 8	8 32	8 16	9 8	9 3	112	15 35	91
Algerian	6 32	6 16	8 0	10 16	8 32	8 3	100	17 18	100
Guyra	8 16	12 16	10 32	10 32	9 24	10 16	129	18 32	108

SEASONAL PLANTING EXPERIMENT—OATS.

MAY PLANTING.

Planted on 5th May, 1932. Seed—40lbs. per acre. 22 % Superphosphate—112lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1931–32.	Percentage Yields, 1931–32.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Mulga	12 16	12 32	14 32	11 24	13 24	13 2	152	20 10	128
Algerian	7 24	8 16	8 32	9 8	8 32	8 22	100	15 30	100
Guyra	9 24	8 16	8 32	10 32	11 8	9 30	114	17 11	110

This year's results indicate that the best yields are obtained from planting a suitable early variety during May. The average results show that a midseason maturing variety is best for April planting.

Manurial Trial.

The object of this experiment is to determine the benefit, if any, from applying fertiliser additional to the superphosphate to the wheat crop growing on "kopi" soil.

The additional fertilisers used were stable manure applied at 15 tons per acre, when the land was ploughed during the previous year, and manganese sulphate applied at 56 lbs. per acre at seeding time.

Accordingly the plots were laid out as follow:—

Plot 1.—112 lbs. superphosphate + 15 tons stable manure per acre.
Plot 2.—112 lbs. superphosphate (Control).
Plot 3.—112 lbs. superphosphate + 56 lbs. managanese sulphate.

Throughout the growing period no difference could be noticed between the control plots and the plots receiving an application of manganese. There was a marked improvement in the plots receiving the application of stable manure. The results obtained are given below:—

MANURIAL TRIAL.

Planted on 12th May, 1932. Variety—Gluyas Early. 22 % Superphosphate—112lbs. per acre. Seed —45lbs. per acre.

Treatment.	Computed Yields per acre.			Average Yields per acre.	Percentage Yields.
	Section 1.	Section 2.	Section 3		
	bus. lb.	bus. lb.	bus. lb	bus lb.	%
15 tons Stable Manure + 112lb. Superphosphate	19 28	20 0	18 24	19 17	140
112lb. Superphosphate ...	13 20	14 24	13 36	13 47	100
56lb. Manganese Sulphate + 112lb. Superphosphate	12 16	12 32	12 0	12 16	89

Only this year's results are available and, therefore, they cannot be taken as conclusive. They indicate, however, that the application of a manganese fertiliser does not result in increased yields. A substantial increase in yield is indicated when a heavy application of stable manure in addition to superphosphate is applied to the wheat crop growing on "kopi" soil.

Fodder Trial.

The object of this trial is to ascertain the relative yields obtained from the common fodder plants when planted on "kopi" soil.

The yields of the green fodders were ascertained by taking cuttings from quadrates of one square yard in area systematically through the respective plots. The seed did not germinate until early June. The yields are shown hereunder:—

FODDER TRIAL.

Planted 25th April, 1932. 22 % Superphosphate—112lbs. per acre.

Fodder.	Rate of Seed per acre.	Computed Yields per acre—Green Fodder.			Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1931–32.	Percentage Yields 1931–32.
		Sec. 1.	Sec. 2.	Sec. 3.				
	lbs.	tons.	tons.	tons.	tons.		tons.	
Noongaar Wheat	45	1·800	1·286	1·929	1·672	61	2·164	55
Mulga Oats	40	3·085	2·572	2·572	2·743	100	3·963	100
Cape Barley	56	4·371	3·085	2·829	3·428	125	4·112	104
Rye	40	4·113	3·599	4·499	4·070	148	4·262	108
Wimmera Rye Grass	4	5·657	6·043	5·786	5·829	212	6·084	154

These results again show that the highest yields of green fodder were obtained from the Wimmera Rye Grass. Its growth in the early stages was slow, but it made excellent progress during August, September and October, attaining an average height of 22 inches. In addition, it remained green longer than the others. It is, therefore, of most value as a late green feed.

For early feed Mulga Oats, Cape Barley and Rye gave satisfactory results and indicate their suitability for early green fodder. Of the three, the rye gave the highest yield after germinating well and making excellent early growth. The Mulga oats, however, gave comparative results most consistent with those of the previous year.

The results from the wheat do not compare at all favourably with the oats, barley or rye.

PASTURE EXPERIMENT PLOTS—DENMARK STUD FARM.

G. K. BARON-HAY, Superintendent of Dairying.
H. G. ELLIOTT, Agricultural Adviser.

Results of the Second Year's Trials with introduced Grasses and Clovers.

The results obtained from the first year's trial with Grasses and Clovers were published in the June, 1932, "Journal of Agriculture," W.A., pages 170-173.

Since the above results were published, much more information regarding the growth and habits of various strains and species have been obtained.

Legumes.—An intensive examination of the conditions was made in July, 1932, with the following results:—

Lucerne.—Five weeks prior to examination all rows were cut, and at the time of inspection the best recovery was made by the "Hunter River" variety, being closely followed by the "Spanish," "Tamworth," "Mudgee," "North Californian," "Peruvian," "Marlborough," and "South African" varieties in that order, those strains showing least recovery being the "Chinese" and "Mongolian."

All varieties were showing the severity of attack of the lucerne flea and red mite, and it can be said that the order of susceptibility, if any, is in the order of their recovery and vigour of growth.

In November, 1932, it was noticed that the "Hunter River" variety had been superseded by the "North Californian" and "Peruvian" strains, and that the "Grimm," "Mongolian," and "Chinese" were the most backward.

Further inspection in February, 1933, again indicated the superiority of the "Hunter River," as it was the most outstanding variety in the plots. The "Mongolian" and "Chinese" varieties were showing very slow and poor growth.

The second year's results still indicate that of the 20 varieties of lucerne planted the "Hunter River" is the best, being the first to come away after being severely attacked by lucerne flea and red mite and later in the year producing the best bulk of feed.

Red Clovers.—The Red Clovers were outstanding in their ability to recover after cutting. All the strains growing showed a great resistance to the attack of the lucerne flea and to a lesser extent the red mite. The "Montgomery" and "Italian" strains were the most resistant and the "Hungarian" strain the least.

The "Italian," "English Early," "English Late," and the "Montgomery" showed recovery after cutting in the order named, while the "Hungarian" strain recovered but slowly.

The next inspection revealed the fact that all of the Red Clovers were doing well and that the "Montgomery" strain would prove the most suitable type for grazing. The "Italian" variety was the best bulk producer and would make a good hay type. This type was still making the best growth when seen during the last inspection.

White Clovers.—During July these plants were suffering severely from the ravages of the lucerne flea and red mite, but despite the early attack they were all growing and producing a fair bulk of feed.

In November, however, the severe infestation by the above pests had reduced the vigour of the White Clovers so much that in many cases the rows were not discernible, and at the last inspection there were only a few odd plants which had survived.

Miscellaneous Legumes.

Lotus corniculatus.—Of all the legumes under trial, *Lotus corniculatus* appears to be the one most resistant to the attack of either the lucerne flea or red mite. Its growth at all periods of the year is good and very even, but its recovery after cutting is a little slow. There is every reason to suppose that this plant will be one of the important constituents in pasture mixtures. Unlike *Lotus major,* it can stand up to more severe drought conditions and drier soils.

Sulla.—The plants in the row made very little growth during the first year, but during the winter of 1932 they made very good growth but did not recover to any extent after cutting. The plants were only slightly attacked by the red mite and do not appear to be affected by the lucerne flea.

Grasses.

Rye Grasses.—The July inspection revealed that of the three perennial types planted last year the most outstanding was the Irish strain which had recovered exceptionally well and made good growth. It, however, was followed closely by the Kentish and Tabor strains. The Italian rye grass made very irregular recovery but produced very good bulk. It is of interest that of the four rye grasses growing, the Tabor perennial strain was the only one which was attacked by the lucerne flea and red mite.

Earlier in the season further strains of rye grasses were planted. All of them germinated well, but in February only one was showing growth, and the four above varieties were very weak, only producing sparse growth.

In the adjoining paddock and elsewhere on the farm, there is what appears to be an excellent type of perennial rye grass. This will be placed under trial during the coming season.

The comparison petween the Wimmera and Italian rye grass for the district is most striking. The "Italian" produces a good bulk of leafy material and is much later to seed than the "Wimmera," which has little or no leaf, being mainly stalk and stem. The "Italian" being a biennial gives good growth for two and in some cases three years.

Cocksfoot.—During the period when lucerne flea and red mite infestation was at its peak, all strains of Cocksfoot under trial showed definite symptoms of damage from attack.

Three types of Cocksfoot are outstanding and have produced excellent growth throughout the year. Apart from tall oat grass, the cocksfoots prove to be the best type of grass to grow in these areas.

Tall Oat Grass.—This grass is a rapid grower, but during the winter and early spring months it is very severely checked by the ravages of the lucerne flea and red mite. It can be said that this grass is the worst affected grass in the whole experiment, but, as soon as the good growing period comes, it rapidly produces a large bulk of very nutritious and palatable foliage, and is one of the most outstanding grasses during the summer months.

Timothy.—All strains under test produced a fair bulk of leaf during the spring and early summer, but all are showing the effects of the present summer conditions, and it is doubtful whether they will survive the second year.

Other Grasses.

Fescue.—These are still persisting and producing a good growth of fine grass, and it is still considered that they will be valuable as a sole grass in pasture mixtures.

Wheat Grasses.—The two types tried have not produced good results, and at the present time the rows show very uneven and poor growth. It is doubtful if they will recover the second summer conditions.

Of the other grasses planted last season, good results are being obtained with *Bromus inermus,* Brome Grass, Waipu Brown Top, and Creeping Bent. The last two are fine leafed types and produce an excellent mat of green material. They are used principally as lawn grasses.

During the spring of last year three types of *Lespedeza* were planted. All varieties germinated well but have not produced much growth, being stunted and yellowish in colour. The cause of the failure this year is attributable to the lack of inoculation with suitable bacteria. It is intended to try these types again next year with inoculation, as the suitable bacterial cultures are now available.

RESULTS OF EXPERIMENTS ON SEMI-BOTTLEBRUSH AND KANGAROO GRASS FLATS, GROUP 113, NORNALUP ROAD, WEST OF DENMARK.

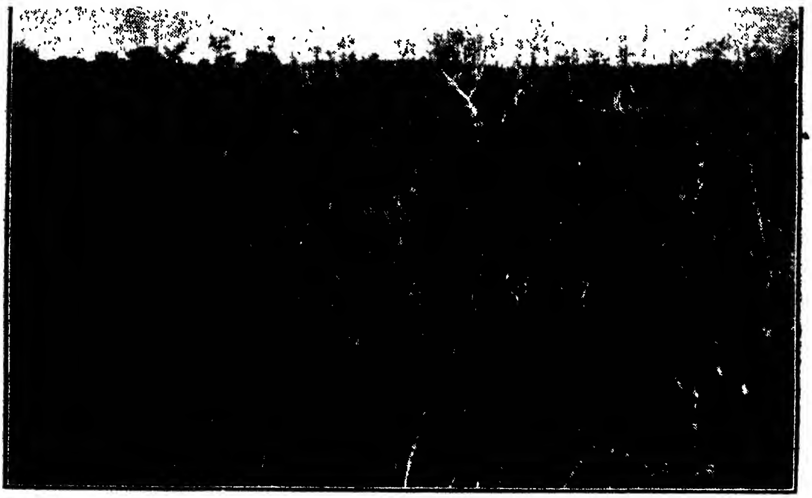
G. K. BARON-HAY,
Superintendent of Dairying.

A number of inquiries have been received recently by the Department regarding methods by which bottlebrush country and kangaroo grass flats may be brought into production, and in some instances recently such country has been cleared and sown with plants totally unsuited to their environment.

At the request of the Group Settlement Department a number of accurately controlled experiments were carried out, commencing in 1925, on the low-lying, generally treeless country between Denmark and Nornalup, with the object of proving its suitability for settlement, and, as no record has yet been made available regarding this type of land, it was thought that this information would now prove of value.

After an inspection of the country two sites were finally chosen, both of six acres each, on the main Denmark to Nornalup Road, Group 113. These areas represent the two types of land found in the flat country at the foot of the karri hills and jarrah rises.

Site 1.—A semi-swamp with a fall to the south, carrying mainly species of bottlebrush (*Beaufortia decussata* and *B. sparsa*) and bog myrtle (*Leptospermum firmum*).



Vegetation on semi-swamp areas treated. Owing to water-logging, root system expands into "boles," causing clearing costs to be high.

The soil is deep and sandy appearing as a loam when wet, but dries to a whitish sand in the summer. It was very fibrous in nature and slightly acid in reaction, containing much organic matter in the surface layers.

Samples of the soil were taken and analysed by the Government Analyst, the analyses indicating that the soils badly needed aeration, and to yield profitable crops would need large applications of phosphatic and potassic fertilisers, and probably a nitrogenous fertiliser, as being acid in reaction the organic nitrogen present would not be in a condition suitable for assimilation by crops. Ultimately this was found to be the case.

Clearing.—Although treeless, clearing proved to be a costly operation, owing to the branching lateral roots of the bottlebrush plants. The cost was as high as £20 per acre by man power, though no doubt this item could be reduced by the use of suitable machinery.

Drainage.—Only three acres of this block were prepared for planting, and it was effectively drained by a main drain and ploughed in narrow lanes three to the chain.

Cultivation.—During 1926 it was decided to plant an area in autumn, using different fertilisers and seed mixtures, and to reserve an equal area under fallow for planting during the autumn 1927.

In the first year it was found extremely difficult to obtain a suitable seed bed in time for planting, due to the fibrous nature of the ground. Owing to the acid reaction of the soil, poor results were to be expected.

Sowing.—This was carried out on May 10th, 1926, during fine weather. The seed and manure were broadcasted, and the land rolled twice after seeding because it was still of a very fibrous character.

Owing to fibrous nature of soil the first ploughing is extremely cloddy. Fallowing for one season is essential.

All plots were sown with the following seed mixture:—

Lotus corniculatus	1 lb. per acre
White Dutch Clover	1½ lb. ,,
Alsike Clover	1 lb. ,,
Cow Grass	1 lb. ,,
Rye Grass (Perennial)	5 lb. ,,
Cocksfoot	5 lb. ,,
Paspalum dilatatum	2 lb. ,,
Subterranean Clover	3 lb. ,,
	19½ lb. ,,

The following fertilisers were sown, each plot being in triplicate:—

1. Superphosphate 200 lb. per acre.
2. Superphosphate 200 lb. + 100 lb. muriate of potash per acre.
3. Superphosphate 200 lb. + 100 lb. sulphate of ammonia per acre.
4. Superphosphate 200 lb. + 100 lb. sulphate of ammonia
   + 100 lb. muriate of potash per acre.

The first report was made on 28th July, 1926, and it was stated that germination on all plots was remarkably good but that the plots fertilised with sulphate of ammonia appeared more healthy.

During August and September, 1926, the plants appeared sickly, the clovers being affected first, and by the following autumn (1927) very few useful pasture plants remained.

An area was topdressed in October, 1926, with a mixture of 100 lb. superphosphate and 50 lb. sulhpate of ammonia. This gave a better growth for a while but the pasture rapidly deteriorated as the dry months approached. Lime also was applied at the rate of 1 ton per acre to one plot but, although beneficial results were obtained for a few weeks after application, the plot was no better than the rest by the end of spring 1926.

It was found, however, that on one plot which was planted with Kikuyu grass and water couch (*Paspalum distichum*) they showed promise of being useful. Couch grass (*Cynodon dactylon*) also produced fair results.

Spring Planting, 1926.—Sown in third week of October.

The following seed mixture was used throughout:—

Subterranean Clover	2 lb.	per acre
White Dutch Clover	3 lb.	"
Lotus major	2 lb.	"
Paspalum dilatatum	12 lb.	"
Rhodes Grass	4 lb.	"
Couch Grass	3 lb.	"
	26 lb.	"

Fertiliser was planted at the following rates:—

Superphosphate	200 lb.	per acre
Sulphate of ammonia	100 lb.	"
Muriate of potash	100 lb.	"

Results.—Germination was good throughout, but the plants did not thrive, although the soil was still moist.

Autumn, 1927.—The areas sown in the autumn and spring of 1926 were topdressed with 1 cwt. of superphosphate. A series of plots were treated with lime at the rate of 1 ton per acre, but the beneficial results obtained were only temporary.

Fallowed Land.—This was sown early in April, 1927, with the same seed and fertiliser mixtures as on the plots sown in 1926.

Here again the germination was good, but soon after the rains ceased the clovers first turned pink, and later the grasses died away, except on a few isolated spots.

Owing to financial reasons, operations ceased on this block until April, 1931, when the following experiment was conducted:—

Two acres of the above ground was ploughed, cultivated twice, and brought to a fine tilth before planting.

The seed and fertiliser were broadcasted during the first week in June.

The following basal seed mixture was used throughout the experiment:—

Lotus major	1 lb.	per acre
White Dutch Clover	1½lb.	"
Alsike Clover	1 lb.	"
Cow Grass	1 lb.	"
Italian Rye Grass	10 lb.	"
Cocksfoot	3 lb.	"
Paspalum dilatatum	2 lb.	"
Subterranean Clover	3 lb.	"
	22½lb.	"

Fertiliser was planted at the following rates in duplicate:—

1. Superphosphate 200 lb. per acre.
2. Superphosphate 200 lb. + Manganese sulphate 56 lb. per acre.
3. Superphosphate 200 lb. + Sulphate of ammonia 100 lb. per acre.
4. Superphosphate 200 lb. + Nitrate of soda 100 lb. per acre.
5. Superphosphate 200 lb. + Sulphate of potash 100 lb. per acre.
6. Superphosphate 200 lb. + Sulphate of potash 100 lb. + Sulphate of ammonia 100 lb. per acre.

Results.—A very good germination of cocksfoot and Italian rye grass was obtained, but very few of the other constituents in the pasture mixtures showed any progress.

Lime.—Across the complete experiment a strip of lime was applied at the rate of 1 ton per acre, and throughout the season the beneficial effects it had on the plants growing were noticeable, as they were stronger and more healthy with a larger portion of clovers showing than was the case in the unlimed portions.

Fertiliser.—It was impossible to detect any difference in the plots from the different manurial treatments. During the summer months the major portion of the grasses were dead, the exceptions being with cocksfoot and Yorkshire fog.

It is of interest to remember that the following factors were against the experiment:—

1. Lateness of planting.
2. Extremely wet and cold winter.
3. Excessively hot and dry summer.

During 1932 it was decided to continue the experiment, sowing only those plants that had shown promise previously. The following plan was adopted:—

1. Land cross disced and harrowed. Unfortunately the use of a T. bar roller was impossible owing to the inability of obtaining one for use.

2. Seed and fertiliser were broadcasted and lightly harrowed in.

3. Seed mixture used was as follows:—

Yorkshire Fog	20 lb. per acre
Cocksfoot	10 lb. „
Drooping Flowered Clover	2 lb. „
	32 lb. „

4. Different fertiliser mixtures were sewn over four plots and duplicated. The mixtures were as follow:—

1. Superphosphate 200 lb. per acre.
2. Superphosphate 200 lb. + Sulphate of ammonia 100 lb. per acre.
3. Superphosphate 200 lb. + Sulphate of potash 100 lb. per acre.
4. Superphosphate 200 lb. + Sulphate of potash 100 lb. + Sulphate of ammonia 100 lb. per acre.

5. Seed and fertiliser sown on 13th May, 1932.

Results.—Germination of the cocksfoot and Yorkshire fog was excellent, with only a sparse germination of clover. By November the cocksfoot, Yorkshire fog, and some *Lotus major* had made excellent growth, and the majority of the ground was covered; odd patches were bare but these places were very spongy and wanted consolidation.

It was almost impossible to detect any real difference in the different fertiliser treatments.

Site 2.—Kangaroo Grass Land, Group 113, 13½ miles from Denmark.

Soil.—A light sandy loam overlying Coffee Rock at a depth varying from a few inches to several feet.

Vegetation.—Practically the only vegetation was kangaroo grass (*Themeda triandra*), blackboys (*Xanthorrhoea Preisii*), and a few stunted jarrahs.

The soil was decidedly acid in reaction. Such soils as these, from experience gained elsewhere, give very disappointing results for the first few years due apparently to some iron compound derived from the underlying "Coffee Rock."

An analysis of the water found on such areas and made by the Government Analyst shows a high content of soluble salts and deleterious iron compounds due to a lack of drainage.

Total Soluble Salts	470.4	grains per gallon
Common Salt	421.4	" " "
Magnesium	13.3	" " "

Reaction Acid.—The sample contained *ferrous iron* and smelt strongly of hydrogen sulphide. Such water is far too saline and acid for irrigating or growing any class of crop.

This area of kangaroo grass country was treated in every way similar to the semi-bottlebrush land.

The policy of leaving this and similar land in fallow for one year after first ploughed had proved economical from the point of view of expense in working down the land to a suitable tilth for planting.

Results—

Germination throughout was good, and the plants apparently thrived until the summer approached when they appeared sickly and quickly died. Similar results were obtained on both new and fallowed land.

The results at this time indicated that extreme caution should be employed in including large areas of this land for cultivation.

This land was again experimented with in 1931 and 1932 and was treated in every way similar to Site 1, Semi-Bottlebrush Country.

Results—

1931.—Seeding was delayed until October on account of the extremely wet conditions. A fair germination was obtained consisting mainly of rye grass and cocksfoot, and more clovers were noticeable than was the case on Site 1. The limed portion was no better than that unlimed, and very little, if any, difference could be detected between the various manurial treatments.

Unfortunately the dry hot summer conditions caused most of the plants to wilt, except in patches where the soil had been sufficiently consolidated

1932.—Sown in the late autumn, excellent germination being obtained, but results were not conclusive owing to the water-logging of the land due to the blocking of the drains.

Conclusions of Experiments to date—

The following points were brought out by the experiments conducted on this class of land:—

1. These soils are infertile but may be developed in conjunction with soils of better type.

2. Essential that adequate drainage be carried out prior to sowing any seeds.

3. Land should be ploughed in early winter, the sods rolled and then allowed to be fallow until following April. It should then be worked down into a reasonable tilth for seeding.

4. Germination of Italian rye grass and cocksfoot very good, but generally poor growth ensues later in the season.

5. Cocksfoot and Yorkshire fog appear more suitable to this class of soil than rye grass.

6. Germination of clovers poor, and those plants which had germinated exhibited signs attributable to soil acidity, became pink and rapidly died.

7. Treatment with one ton of lime per acre is distinctly beneficial, although this quantity does not appear sufficient to counteract acidity.

8. Yorkshire fog, cocksfoot, and *Lotus major* are easily the most successful plants among the surviving herbage. Yorkshire fog probably will give the best results for several years. This grass is stated to provide good grazing in parts of New Zealand where the land consists of peaty swamps badly drained. This approximates to the conditions on the type of land under review. It, therefore, is considered that trials with this grass are warranted.

THE ROYAL AND DISTRICT AGRICULTURAL SOCIETIES' 50-ACRE CROP COMPETITIONS, 1932.

I. THOMAS,
Superintendent of Wheat Farms.

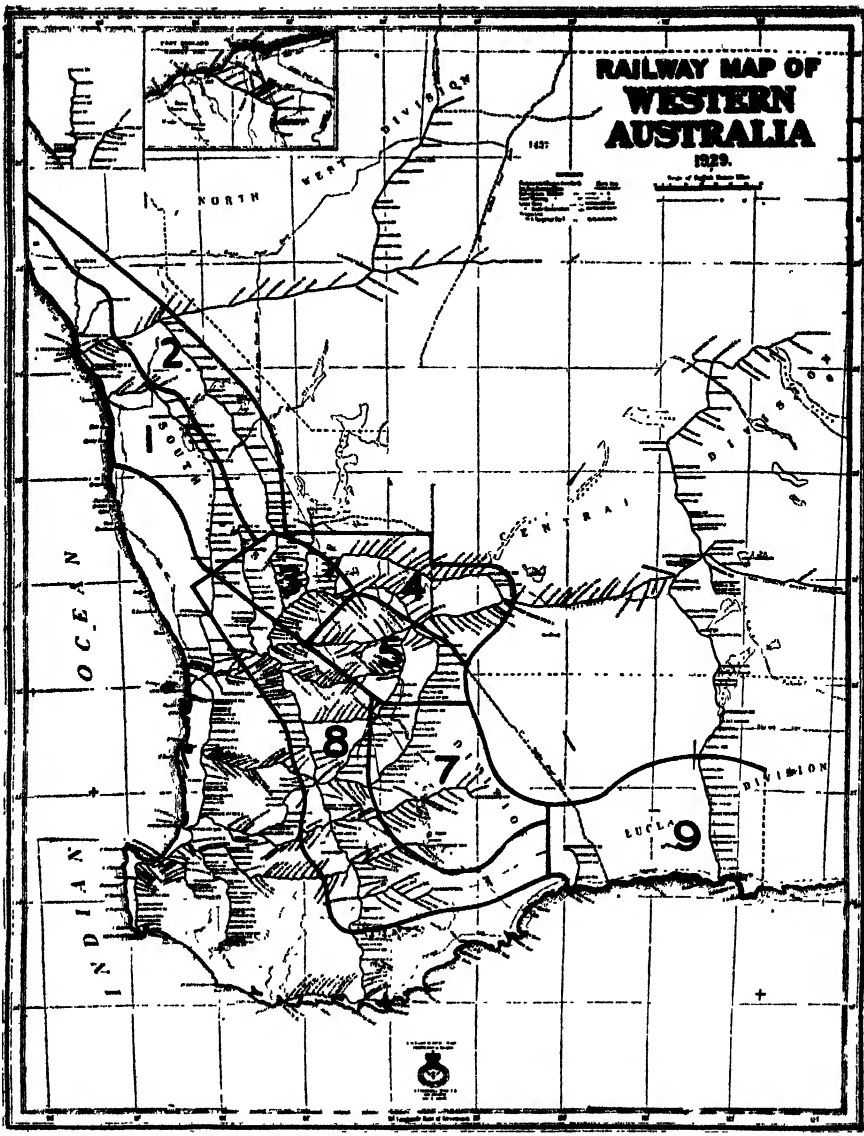
The history of these competitions has advanced a further year and there are now twelve years' results available. These give an excellent indication of the rapid improvement in general farming practice during that period and have proved that, with the application of sound methods as shown by the details of the successful entrants, a considerable improvement in average yields would result.

Considerable interest is shown in these competitions throughout the wheat belt, although more particulary so in the later settled areas. Entry is made through the competitions held by local Agricultural Societies. Where these are not held. entry is accepted direct with the parent body, the Royal Agricultural Society, so that no farmer in any part of the wheat belt who is desirous of competing is prevented from doing so.

As can be readily understood, there is a considerable variation in rainfall, soil, etc., in a wheat belt so widely extended. For these reasons it has been subdivided into eight zones in such a manner that districts having similar interests and climatic conditions have been grouped together. In this way farmers may compete with each other more equitably. The accompanying map shows the eight zones referred to.

In each of these zones a championship prize of £10 and a second prize of £2 10s. are awarded. The competitors eligible for these awards are the first and second prize winners of the competitions held by the affiliated District Agricultural Societies and those competitors who have entered direct with the Royal Agricultural Society because of no district competition being conducted in their own district.

In addition to these zone prizes the Royal Agricultural Society each year offers a special prize of £5 5s. to the competitor in any zone obtaining the highest calculated bushel yield per acre. The prize was first offered in 1925.



The conditions of the competitions require that the crop shall be grown on fallowed land, shall not be less than 50 acres in area of one variety, and shall be judged under the following scale of points:—

Yield	50 points.
Freedom from weeds	10 points.
Freedom from disease	10 points.
Freedom from admixture	15 points.
Evenness of growth	15 points.
	100 points.

The system adopted has been to allot one point for each calculated bushel yield, which is determined not by estimation but upon that calculated from portions of the crop obtained from small areas taken systematically throughout the crop. These samples are then threshed and the grain weighed.

Since the inception of the Royal and District Crop Competitions the judges have been Departmental Officers attached to the Wheat Branch of the Department of Agriculture.

The awards and judges' reports, together with a detailed analysis of the cultural details of all competitors, have been prepared and will be found in the following pages.

ZONE 1.

Judge—F. L. Shier, Agricultural Adviser.

Three Springs Society—4 competitors.

Carnamah Society—9 competitors.

Total—13 competitors.

THREE SPRINGS AGRICULTURAL SOCIETY.

The rainfall recorded at Three Springs was as follows:—

— —	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Three Springs ...	91	.	188	101	346	184	264	618	91	218	1,721	2	12	2,115

The awards made and the cultural details are tabulated hereunder:—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Hebiton, J. K. ...	Three Springs	Bena ..	37	9	9	13	14	82
Lynch, Senator ...	Mt. Leonora	Gluclub ...	34	8	9	13	13	77
Byrne & Sons, E. L.	Three Springs	Bena ...	33	8	9	13	13	76
Padbury, Wm. ...	Three Springs	Bena ...	29	9	9	12	13	72

CULTURAL DETAILS.

Competitor.	Years cropped.	Timber.	When ploughed.	Implement.	Subsequent cultivations.	Variety.	When Planted.	Rate of Seed.	Rate of Super.	Seed treatment.	Graded.	Disease.
Hebiton, J. K.	Old land	York gum	July	Disc	Cross disc ploughed in September. Springtyne cultivated March dry, and in April after rain. Planted with combined cultivator drill	Bena	2nd week May	50	80	Copper carbonate	Yes	Trace Rust
Lynch. Senator	Five crops	Salmon gum	June-July	Mould-board	Cultivated with disc cultivating plough October. Springtyne cultivated early April after rain. Planted with combined cultivator drill	Gluclub	2nd week May	58	60	Copper carbonate	Yes	Trace Take-all
Byrne & Sons, E. K.	Old land	York, salmon gum, and morrell	July	Disc	Cross-ploughed October. Springtyne cultivated twice after rains in March. Planted with combined cultivator drill	Bena	Mid May	60	80–90	Copper carbonate	Yes	Trace Rust
Padbury, W. ...	Old land	Salmon gum, York gum, and gimlet	July	Disc	Springtyne cultivated October and after April rains. Planted with combined cultivator drill	Bena	1st week May	52	93	Copper carbonate	Yes	Trace Rust

CARNAMAH AGRICULTURAL SOCIETY.

The rainfalls recorded at Carnamah, Coorow, and Winchester were as follow:—

—	Jan	Feb	Mar	Apl	Growing Period							Nov	Dec	Total for year
					May	June	July	Aug	Sep	Oct	Total			
Carnamah	54		152	136	266	185	342	757	63	262	1,875		16	2,233
Coorow	73		205	93	293	179	227	719	84	218	1,720		1	2,092
Winchester	89		162	120	273	167	266	740	92	205	1,743	3	13	2,130

The awards made and the cultural details are tabulated hereunder:—

Awards.

Competitor	Address	Variety	Yield 50 points	Freedom from Weeds 10 points	Freedom from Disease 10 points	Freedom from Admixture 15 points	Evenness of Growth 15 points	Total 100 points
Forrester, J. K.	Carnamah	Gluyas Early	40	8	9	14	14	85
Morecombe, B. T.	Coorow	Gluyas Early	34	9	9	13	13	78
Bothe, B. D.	Coorow	Bencubbin	32	9	9	14	13	77
Bowman, J.	Carnamah	Felix	33	8	8	13	14	76
Sharp, Mrs.	Carnamah	Carrabin	30	9	9	14	14	76
Nineham Bros.	Carnamah	Merredin	31	8	9	12	13	73
Robertson, C.	Carnamah	Bencubbin	31	7	8	14	13	73
Diamond, R. McW.	Carnamah	Merredin	29	9	9	12	13	72
Mosedale & Fowler	Winchester	Merredin	24	8	8	13	12	65

CULTURAL DETAILS.

Competitor.	Years cropped.	Timber.	When ploughed.	Implement.	Subsequent cultivations.	Variety.	When Planted.	Rate of Seed	Rate of Super.	Seed treatment.	Graded.	Disease.
Forrester, J. K.	6	York gum and black mallee	June	Disc	Cultivated with disc cultivating plough. Springtyne cultivated end September. Disc cultivated third week May. Planted with combined cultivating drill	Gluyas Early	1st June	50	120	Copper carbonate	Yes	Trace Flag Smut
Morcombe, P. T.	5	Salmon gum and gimlet	July	Disc	Springtyne cultivated September and harrowed. Springtyne cultivated after March rains. Planted with combined cultivator drill	Gluyas Early	1st week May	60	100	Copper carbonate	Yes	Trace Flag Smut
Bothe, B. D. ...	Old land	Salmon gum	July	Mouldboard	Springtyne cultivated September, and again after April rains. Planted with combined cultivator drill	Bencubbin	2nd week May	60	90	Copper carbonate	Yes	
Bowman, J. ...	Old land	...	June-July	Disc	Springtyne cultivated September and October, and again after March rains, followed by disc harrows. Planted with disc drill	Felix	2nd week May	50	120	Untreated	Yes	Trace Ball Smut
Sharp, Mrs. ...	5	Salmon gum	June	Disc	Cultivated with disc cultivating plough in September. Springtyne cultivated early April after rain. Planted with Combined cultivator drill	Carrabin	End of May	48	90	Copper carbonate	Yes	
Nineham Bros.	6	Salmon gum	June	Disc	Springtyne cultivated September. Planted with combined cultivator drill	Merredin	4th week May	50	75	Copper carbonate	Yes	
Robertson, C. ..	Old land	Salmon gum, gimlet and jam	July	Disc and mouldboard	Cultivated with disc cultivating plough October, and twice prior to seeding. Planted with disc drill	Bencubbin	1st week May	50	90	Copper carbonate	Recleaned	Trace Take-All
Diamond, R. Mc. W.	Old land	Salmon and York gum	end July	Disc	Springtyne cultivated September and after April rains Planted with combined cultivator drill	Merredin	Last week May	50	90	Copper carbonate	Yes	
Mosedale & Fowler	3	Jam and York gum	August	Disc	Planted with combined cultivator drill	Merredin	1st week May	50	90	Copper carbonate	Yes	Take-all

ZONE 2.

Judge—J. H. Langfield, Manager Merredin Experiment Farm.

Royal Society—1 competitor.

Dalwallinu Society—7 competitors.

Total—8 competitors.

DALWALLINU AGRICULTURAL SOCIETY.

The rainfall recorded at Dalwallinu was as follows:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Dalwallinu ...	138	...	268	91	222	118	200	555	80	140	1,315	...	11	1,823

The awards made and the cultural details are tabulated hereunder:—

Awards.

Competitor.	Address.	Variety.	Calculated Yield. 50 points	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Butcher, O. ...	Dalwallinu ...	Gluclub ...	42	9	9	13	14	87
Locke, F. C. ...	Dalwallinu ...	Bencubbin .	36	8	10	14	13	81
Sutherland Bros. ...	Dalwallinu ...	Gluyas Early	35	8	9	14	13	79
Sutcliffe Bros. ...	Dawallinu ...	Gluclub ...	34	9	8	14	13	78
Honner, R. J. ...	Dalwallinu ...	Gluyas Early	30	8	9	14	13	75
Bradford Bros. ...	Dalwallinu ...	Gluclub ...	31	8	8	13	13	73
Roberts, E. T. ...	Dalwallinu ...	Pusa ...	20	7	8	12	13	[illegible]

CULTURAL DETAILS.

Competitor.	Timber.	When ploughed.	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
					in.				lbs.	lbs.			
Butcher, O. ...	Salmon gum, gimlet	June–July	Good	Mouldboard	4	Springtyne cultivated prior to seeding with a disc drill	Gluclub	1st week May	33	112	Copper carbonate	Yes	
Locke, F. C. ...	Salmon gum, gimlet	June–July	Good	Mouldboard	4	Springtyne cultivated August, Sept., Jan. and March, and twice prior to seeding	Bencubbin	End May	36	100	Copper carbonate	Yes	
Sutherland Bros....	Salmon gum, gimlet	August	Good	Disc ...	3–4	Springtyne cultivated Sept.; disc cultivated October, and springtyne cultivated April	Gluyas Early	3rd week May	45	100	Copper carbonate	Yes	
Sutcliffe Bros. ...	Salmon gum, gimlet	June–July	Good	Disc cultivating plough	3	Springtyne cultivated twice in August, once in Sept. and April. Planted with combined cultivator drill	Gluclub	2nd week May	34	90	Copper carbonate	Yes ...	Trace Flag Smut
Honner, R. J. ...	Salmon gum, gimlet	June–July	Good	Mouldboard	4	Springtyne cultivated three times in Spring, again in March and harrowed and cultivated prior to planting with combined cultivator drill	Gluyas Early	Mid-May	45	120	Copper carbonate	Yes	
Bradford Bros. ...	Salmon gum, gimlet	June–July	Good	Disc cultivating plough	3–4	No cultivations prior to planting	Gluclub	Mid-May	35	90	Copper carbonate	Yes ...	Flag Smut
Roberts, E. T. ...	Salmon gum, gimlet	July ...	Good	Mouldboard	3–4	Springtyne cultivated in Sept., April, and twice prior to planting	Pusa	June	50	70	Untreated	Yes ...	Ball Smut

ROYAL AGRICULTURAL SOCIETY.

The following is the rainfall recorded at Indarra, where the only entry direct with the parent body was made in this zone:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Tenindewa ...	119	8	64	120	259	151	192	362	60	137	1,161	...	35	1,507

The award and cultural details are as set out below:—

Award.

Competitor.	Address.	Variety.	Calculated Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Moore, T.	Indarra ...	Bencubbin ...	39	9	10	14	14	86

CULTURAL DETAILS.

Competitor.	Timber.	When ploughed.	Condition of land.	Implement.	Depth.	Subsequent cultivations.
Moore, T.	Yorkgum, jam	June	Good	Disc cultivating plough	ins. 3	Springtyne cultivated in August, September, January. Planted with a combined cultivator drill

Competitor.	Variety.	Planted.	Rate of Seed,	Rate of Super.	Seed treatment.	Graded.	Diseases.
Moore, T.	Bencubbin	1st week May	lbs. 55	lbs. 100	Copper carbonate	Recleaned	

ZONE 3.

Judge—N. Davenport, Agricultural Adviser.

All four competitors in this zone entered direct with the Royal Agricultural Society.

The rainfalls as recorded at the respective centres are as follow:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Wongan Hills ...	43	...	107	111	302	158	384	515	85	133	1,577	...	...	1,838
Cowcowing ...	72	91	78	171	173	89	259	341	66	162	1,090	1	8	1,511
Goomalling ...	63	5	55	92	260	169	358	465	88	200	1,540	4	8	1,776

The awards made and cultural details are as set out below:—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Mt. Rupert Co. ...	Wongan Hills	Merredin ...	37	9	8	14	14	82
Jones, W. W. ...	Cowcowing...	Bencubbin ...	36	9	9	14	13	81
Lane, W. H. and V. R.	Wongan Hills	Ford ...	34	8	8	13	13	76
Woodfield, N. ...	Goomalling ...	Bena ...	31	9	8	14	12	74

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement	Depth.	Subsequent Cultivations.	Variety.	Planted	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
Mt. Rupert Co.	Old land	Salmon gum, gimlet and morrel	Mid June	Good	Mouldboard	in. 4	Springtyne cultivated Aug. and May. Planted with combined cultivator drill; harrowed after seeding	Merredin	2nd week June	lb. 60	lb. 80	Copper carbonate	Yes	Flag Smut and Take-all
Jones, W. W.	5	Salmon and yorkgum and little morrel	Early July	Good	Disc ..	4	Planted with combined cultivator drill with light harrows attached	Bencubbin	1st week May	50	90	Copper carbonate	Yes	
Lane, W. H. & V. R.	8	Salmon gum and gimlet	Cultivated June: Ploughed August	Fair to good	Mouldboard	3	Springtyne cultivated April and prior to drilling. Planted with disc drill with light harrows attached	Ford ...	2nd week May	60	90	Copper carbonate	Yes	Take-all and Flag Smut
Woodfield, N. H. C.	Old land	Salmon and yorkgum and scrub	July	Fair	Disc cultivating plough	3	Rigidtyne scarified Sept., part in October, again in April. Planted with disc drill with light harrows attached	Bena ...	1st week May	60	90	Copper carbonate	Yes	Rust. Flag Smut and Take-all

ZONE 4.

Judge—G. L. Throssell, Agricultural Adviser.

Southern Cross Society—5 competitors.

Nungarin Society—13 competitors.

Mt. Marshall Society—2 competitors.

Total—20 competitors.

SOUTHERN CROSS AGRICULTURAL SOCIETY.

The rainfalls as recorded at Turkey Hill, Ghooli, and Corinthian were as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Turkey Hill ...	58	20	76	61	210	68	101	242	49	318	988	...	92	1,295
Yilgarn Exp. Farm	58	36	61	65	186	92	121	278	53	210	940	...	36	1,196
Corinthian ...	21	23	69	70	213	91	142	266	69	172	953	...	32	1,268

The awards made and cultural details are as set out below:—

Awards.

Competitor.	Address.	Variety.	Calculated Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Smith, P. J. ...	Turkey Hill	Noongaar ...	22	8	8	13	13	64
Stevens, G. K. ...	Ghooli ...	Bencubbin ...	18	9	9	14	12	62
Stevens, G. K. ...	Ghooli ...	Nabawa ...	18	9	9	14	11	61
Stevens, G. K. ...	Ghooli ...	Noongaar ...	17	8	9	13	11	58
Mell, A. J. ...	Corinthian ...	Noongaar ...	13	7	9	8	11	48

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
Smith, P. J. ...	1st	Salmon gum, gimlet, jam and wattle	July-Aug.	Good	Disc ...	in. 3	Planted with combined cultivator drill	Noongaar	3rd week May	lb. 24	lb. 54	Copper carbonate	Yes	Trace of Flag Smut
Stevens, G. K.	1st	Salmon gum, and gimlet	June	Good	Disc ...	3-4	Springtyne cultivated Sept., and planted with combined cultivator drill	Ben-cubbin	2nd week May	27	80	Copper carbonate	Yes	
Stevens, G. K.	1st	Salmon gum and gimlet	June	Good	Disc ...	3-4	Springtyne cultivated Sept., and planted with combined cultivator drill	Noongaar	3rd week May	27	80	Copper carbonate	Yes	Badly affected by frost
Stevens, G. K.	1st	Salmon gum, and gimlet	June	Good	Disc ...	3-4	Springtyne cultivated Sept., and planted with combined cultivator drill	Nabawa	End of 2nd week May	27	80	Copper carbonate	Yes	
Mill, A. J. ...	3rd	Mallee and jam scrub	July	Patchy	Disc ...	3	Springtyne cultivated Oct., planted with combined cultivator drill	Noongaar	Mid May	30	75	Copper carbonate	Re-cleaned	

NUNGARIN AGRICULTURAL SOCIETY.

The rainfalls as recorded at the various centres were as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Nukarni	53	12	69	125	138	93	277	231	75	263	1,077	...	22	1,358
Wilgoyne ...	58	6	60	90	107	57	175	324	29	146	838	...	46	1,098
Nungarin ...	73	6	67	98	192	66	279	262	60	239	1,098	...	45.	1,387
Mukinbudin ...	47	23	102	93	140	64	190	340	64	163	961	...	25	1,251
Mangowine ..	110	1	58	76	101	45	273	270	49	192	930	...	...	1,175
Talgomine ...	143	23	77	93	159	94	253	258	42	252	1,058	...	29	1,423

The awards made and cultural details are set out below:-

Awards.

Competitor.	Address.	Variety.	Estimated Yield. 50 points.	Freedom from Weeds 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Creagh Bros. ...	Kwelkan ...	Gluyas Early	33	9	8	13	13	76
Evans, L. D. ...	Nukarni ...	Bencubbin ...	30	9	8	14	13	74
Clamp, Geo. ...	Barbalin ...	Gluyas Early	27	9	8	13	12	69
Maddocks, N. G. ...	Wilgoyne ...	Gluyas Early	25	9	7	14	13	68
Philbey, F. G. ...	Nungarin ...	Gluyas Early	24	8	7	14	14	67
Manuel, C. J. ...	Mukinbudin	Gluyas Early	24	9	8	14	12	67
Clamp, A.	Barbalin ...	Gluyas Early	26	8	7	12	13	66
Harris, E. G. ...	Mukinbudin	Gluyas Early	23	9	7	13	13	65
Jones, D.	Nungarin ...	Nabawa ...	24	8	7	13	13	65
Williams, F. A. ...	Mangowine...	Carrabin ..	22	8	8	13	13	64
Young, G. T. ...	Talgomine ...	Noongaar ...	24	7	6	13	12	62
Jolly, H.	Mangowine...	S.H.J. ...	21	8	7	13	12	61
Maddocks, Geo. ...	Wilgoyne ...	Nabawa ...	20	7	7	12	12	58

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety	Planted.	Rate of Seed	Rate of Super	Seed Treatment.	Graded.	Diseases.
Creagh Bros.	6	Salmon gum, gimlet and yorrell	End July	Good	Heavy Disc	in. 4	Rigid-tyne scarified end September; springtyne cultivated end April with combined cultivator drill	Gluyas Early	Last week May	lbs. 45	lbs. 90	...	Yes ...	Flag Smut and Take-all
Evans, L. D.	3	Salmon gum and mallee	Early June	Good	Disc cultivating plough	3	Rigid-tyne scarified July August; harrowed mid-August; planted with combined cultivator drill	Benecubbin	Early May	45	75	...	Yes ...	Take-all
*Clamp, Geo.														
Maddock, N. G.	3	Salmon gum and mallee	June and July	Good	Part rigid-tyne scarified, remainder with disc cultivating plough	3 to 4	Springtyne cultivated mid-August; planted with combined cultivator drill	Gluyas Early	3rd week May	33	60	Copper carbonate	Yes ..	Take-all
Philby, F. C.	4	Salmon gum and mallee	Mid July	Good	Disc cultivating plough	3	Ploughed back mid-Sept: cultivated with disc cultivating plough prior to seeding with a combined cultivator drill	Gluyas Early	1st week May	50	100	Copper carbonate	Yes ...	Flag Smut and Take-all
Manuel, C. J.	6	Salmon gum and gimlet	Early June	Good	Mouldboard	3½	Springtyne cultivated in August, Sept and prior to drilling Planted with disc drill	Gluyas Early	Mid-May	45	90	Copper carbonate	Yes ...	Take-all and Flag Smut
Clamp, A. ...	3	Salmon gum, jam and mallee	Early June	Good	Disc cultivating plough	4	Springtyne cultivated end July; harrowed immediately after, cultivated again in Sept. Planted with combined cultivator drill	Gluyas Early	Last week May	45	90	Copper carbonate	Yes ...	Take-all and Flag Smut
Harris, E. G.	6	Salmon gum and gimlet	Mid-June	Good	Rigidtyne scarifier	3	Rigidtyne scarified July; cultivated with disc cultivating plough August and again prior to seeding and after a working by a springtyne cultivator. Planted with a combined cultivator drill	Gluyas Early	1st and 2nd week May	42	70	Copper carbonate	No ...	Take-all Flag Smut and Bunt

* Details not available

CULTURAL DETAILS—*continued.*

Competitor.	No. of years cropped.	Timber.	Whed ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
						in.				lb.	lb.			
Jones, D. ...	Old land	Salmon gum and gimlet	June-July	Good	Disc cultivating plough	4	Twice cultivated with disc cultivating plough, and again with springtyne cultivator	Nabawa	Last week April	45	90	Copper carbonate	Yes	Take-all
Williams, F. A.	Old land	...	July	Good	Disc cultivating plough	3	Springtyne cultivated in Sept.; planted with combined cultivator drill: harrowed after seeding	Carrabin	Mid-May	45	80	Copper carbonate	Yes	
Young, G. ...	4	Salmon gum and gimlet	Early June	Rather dry	Disc ...	3½	Springtyne cultivated in Aug., again after rain in March, and again prior to seeding, which was done with a combined cultivator drill with light harrows attached	Noongaar	3rd week May	45	75	Copper carbonate	Yes	Flag Smut and Take-all
Jolly, H. ...	Old land	Salmon gum, gimlet, mallee and tea-tree	June	Good	Mouldboard	3–4	Harrowed mid Sept. and planted with combined cultivator drill	S.H.J.	1st week May	60	75	Copper carbonate	Yes	
Maddock, N. G.	Old land	Jam ...	June	Good	Heavy Disc	4	Cultivated with disc cultivating plough during Sept., and prior to seeding. Planted with disc drill with light harrows attached	Nabawa	3rd week April	45	90	Copper carbonate	Yes	Take-all

MT. MARSHALL AGRICULTURAL SOCIETY.

Judge—G. L. Throssell, Agricultural Adviser.

The rainfall as recorded at Bencubbin was as follows:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Bencubbin ...	77	..	125	98	166	77	205	390	78	188	1,104	..	15	1,419

The awards made and cultural details are as set out below:—

Awards.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Hopwood, B. W. G.	Mt. Marshall	Bencubbin ...	27	8	8	14	13	70
Thompson, M. A. ...	Mt. Marshall	Gluyas Early	17	7	6	14	11	55

CULTURAL DETAILS.

Competitor.	No of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.
Hopwood, B. W. G.	5	Light mallee and jam	June	Good	Disc ...	in. 4	Springtyne cultivated in August Planted with combined cultivator drill
Thompson, M. A.	3	Salmon gum and gimlet	July	Good	Heavy disc	4	Cultivated with cultivating plough end August and early Sept.; springtyne cultivated Oct. Planted with combined cultivator drill

Competitor.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
Hopwood, B. W. G. ...	Bencubbin	End of April	lb. 45	lb. 135	Copper carbonate	Yes	Take-all
Thompson, M. A. ...	Gluyas Early	2nd week May	33	80	Copper carbonate	Yes	Root-rot

ZONE 5.

Judge—R. P. Roberts, Agricultural Adviser.

Royal Society—1 competitor.

Merredin Society—11 competitors.

Bruce Rock Society—3 competitors.

Total—15 competitors.

MERREDIN AGRICULTURAL SOCIETY.

The rainfalls as recorded at the various centres were as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Baandee	29	...	59	70	143	74	234	353	70	296	1,170	†	†	*1,328
Walgoolan ...	139	...	75	99	170	100	280	261	123	296	1,230	†	†	*1,543
Belka	71	8	53	93	194	147	325	319	91	305	1,381	2	14	1,622
Ulva	49	7	73	68	179	98	343	297	57	339	1,313	...	14	1,524
Merredin ...	72	14	68	51	173	92	289	286	79	296	1,215	...	15	1,435
Norpa	81	11	61	51	169	105	347	241	72	362	1,296	†	†	*1,500
Burracoppin ..	49	...	76	81	132	105	291	224	32	292	1,076	...	25	1,307
Nukarni	53	12	69	125	138	93	277	231	75	263	1,077	...	22	1,358

* Total to October. † Returns not to hand.

The awards made and the cultural details are as set out below:-

Awards.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Kay, J.	Baandee ...	Gluclub ...	40	8	8	12	14	82
Teasdale, F. ...	Korbel ...	Bencubbin ...	36	8	8	14	13	79
Barnet, L.	Walgoolan ...	Gluyas Early	35	7	8	14	14	78
Cook, W. T. ...	Walgoolan ...	Gluyas Early	31	9	8	13	14	75
Teasdale, H. ...	Ulva	Geeralying ...	31	7	8	14	13	73
Smallacombe, T. H.	Merredin ...	Gluclub ...	28	9	8	13	13	71
Flockart, I. H. ...	Korbel ...	Gluyas Early	28	7	7	14	14	70
Thynne Bros. ...	Norpa ...	Merredin ...	29	9	7	13	12	70
Maughan, D. ...	Walgoolan ...	Gluyas Late	28	8	7	11	14	68
Lambert, J. B. ...	Burracoppin	Merredin ...	30	8	7	10	13	68
Cockram, W. H. ...	Nukarni ...	Noongaar ...	22	6	7	13	12	60

CULTURAL DETAILS.

Competitor.	Years cropped.	Original timber.	When ploughed.	Condition of land.	Implements.	Depth Depth	Subsequent cultivations.	Variety.	Rate of seed.	Rate of super.	Graded.	When planted.	Disease.
						ins.			lb.	lb.			
Kay, J.	Old land	Salmon gum, gimlet and morrel	July	Fairly good	Mould-board	4	Cultivated with a rigid tyne scarifier in August-September and again before seeding	Gluclub	50	100	Yes	3rd week in May	A little flag smut and trace of take-all.
Teasdale, F. O. ...	Old land	Gimlet and salmon gum	July	Good	Mould-board	3	Cultivated with a springtyne implement in September and again before seeding	Bencubbin	45	112	Yes	2nd week in May	A little take-all.
Barnet, L. T. C. ...	Old land	Salmon gum, gimlet and a little morrel	June-July	Good	Disc	3–4	Reploughed in August, and part cultivated with a springtyne implement in Sept; springtyne cultivated before seeding	Gluyas Early	39	130	Yes	Middle of May	A little flag smut and take-all.
Cook, W. T. ...	4th crop	Morrel and mallee	June-July	Fair	Scarifier	3	Worked with a rigid tyne cultivator in August; cultivated with a springtyne implement in September, and with the rigid tyne implement prior to seeding.	Gluyas Early	43	90	Yes	2nd week in May	A little flag smut and take-all and a trace of bunt
Teesdale, H. W. ...	Old land	Gimlet and a little salmon gum	June-July	Good	Disc	3	Scarified in September and again before seeding	Geeralying	44	100	Yes	3rd week in May	A little take-all.
Smallacombe, T. H.	Old land	Mallee, jam scrub, and tea-tree	July	Good	Disc	3	Cultivated with a disc implement in August and with a springtyne implement in Sept.; springtyne cultivated prior to seeding	Gluclub	53	90	Yes	2nd week in May	A little flag smut and take-all.
Flockart, I. H. ...	Old land	Gimlet and salmon gum	June	Good	Skim mould-board and disc	3	Skim ploughed in August; cultivated with springtyne cultivator in October	Gluyas Early	45-50	112	Yes	Last week in May	Some flag smut and a trace of take-all.
Thynne Bros. ...	3rd crop	Gimlet, jam scrub, and morrel	June-July	Good	Disc	3	Springtyne cultivated in September	Merredin	45	80	Yes	3rd week in May	Flag smut and take-all.

CULTURAL DETAILS—*continued.*

Competitor.	Years cropped.	Original timber.	When ploughed.	Condition of land.	Implements.	Depth.	Subsequent cultivations.	Variety.	Rate of seed.	Rate of super.	Graded.	When planted.	Disease.
						ins.			lb.	lb.			
Maughan, D. ...	3rd crop	Salmon gum and gimlet	First week in June	Good	Disc	3	Disced in August. Springtyne cultivated in September and cultivated with a rigid tyne implement in March	Late Gluyas	45	136	Yes	1st week in May	Trace of flag smut and a little take-all.
Lambert, J. B. ...	5th crop	Salmon gum and gimlet	June	Good	Disc	3	Cultivated with a springtyne implement in September and again after rain in February	Merredin	39	80	Yes	2nd week in May	Flag smut and a little take-all.
Cockram, W. H. ...	Old land	Gimlet and salmon gum	July	Good	Disc	3½–4	Reploughed in August; springtyne cultivated in September	Noongaar	70	90	Yes	2nd week in June	Take-all and a trace of flag smut.

BRUCE ROCK AGRICULTURAL SOCIETY.

The rainfall as recorded at Bruce Rock was as follows:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Bruce Rock ...	70	8	29	57	230	99	288	355	62	340	1,374	...	8	1,546

The awards made and the cultural details are as set out below:-

Awards.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Smith, C., & Sons ...	Bungulluping	Gluclub ...	37	9	9	13	13	81
Smith, C. & A. H. ...	Yalbarrin ...	Gluclub ...	32	8	7	13	13	73
Farrell, F. C., & Sons	Bruce Rock	Bencubbin ...	32	8	7	12	12	71

CULTURAL DETAILS.

Competitor.	Years cropped.	Original timber	When ploughed.	Condition of land.	Implement.	Depth.	Subsequent cultivations.	Variety.	Rate of Seed.	Rate of Super.	Graded.	When planted.	Disease.
						in.			lb.	lb.			
Smith, C. & Sons	Old land	Salmon gum and gimlet	June	Good	Disc ...	3	Cultivated with a rigid tyne implement at the end of August	Gluclub	35	90	Yes	4th–11th May	Trace of take-all and flag smut.
Smith, C. & A. H.	5th crop	Salmon gum and gimlet, and a little mallee	Early June	Good	Rigid tyne scarifier	2–2¼	Cultivated with a rigid tyne implement the first week in August, and again in early September. Cultivated with a springtyne implement in April	Gluclub	45	90	Re-cleaned	Middle of May	Some flag smut and take-all.
Farrall, F. C. & Sons	Old land	Salmon gum, gimlet, and a little mallee	Early June	Good	Mould-board and disc	4	Half rigid tyne cultivated and balance disc cultivated in mid-August. Springtyne cultivated in October and January. Springtyne cultivated last week in April	Bencubbin	54	96	Yes	7th–8th May	Take-all.

ROYAL AGRICULTURAL SOCIETY.

There was only one competitor entered direct with the parent Society in this zone, viz., Mr. J. Deane Hammond.

The rainfall recorded at "Cuttening" was as follows:—

———	Jan.	Feb.	Mar.	Apl.	Growing Period. May	June.	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Cuttening ...	49	...	37	80	187	144	310	371	94	352	1,458	...	...	1,624

The award made and the cultural details are as set out below:—

Awards.

Competitor.	Address.	Society.	Variety.	Calculated Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 points.
Hammond, J. Deane	Kellerberrin	Royal ...	Bencubbin	30	8	8	14	13	73

CULTURAL DETAILS.

Competitor.	Years cropped.	Original timber.	When ploughed.	Condition of land.	Implement.	Depth.	Subsequent cultivations.
Hammond, J. D.	Old land	Salmon gum and gimlet	July	Good	Mouldboard	5in.	Springtyne cultivated in September and again in October; springtyne cultivated in March, and again in May, prior to seeding

Competitor.	Variety.	Rate of Seed.	Rate of Super.	Graded.	When planted.	Disease.
Hammond, J. D.	Bencubbin	60	100	Yes	10th May	Some take-all and traces of rust and bunt.

ZONE 7.

Judge—A. S. Wild, Agricultural Adviser.

Royal Society—1 competitor.
Karlgarin Society—24 competitors.
Harrismith Society—5 competitors.
Kulin Society—10 competitors.
Lake Grace Society—8 competitors.
Kukerin Society—12 competitors.
Total—60 competitors.

KARLGARIN AGRICULTURAL SOCIETY.

The rainfalls as recorded at Karlgarin, Kondinin, Hyden Rock, and Lake Carmody were as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Karlgarin ...	50	3	31	33	204	96	254	290	127	277	1,248	5	9	1,379
Kondinin ...	43	2	47	102	291	112	283	372	201	340	1,599	4	6	1,803
Lake Carmody ...	79	...	55	71	180	139	254	290	127	277	1,267	†	†	*1,472
Sth. Hyden Rock	70	3	54	74	146	108	244	210	73	278	1,059	...	4	1,264
Nth. Hyden Rock (Camel Peaks)	78	5	36	104	211	125	282	267	99	270	1,254	...	...	1,477

† Records not to hand. * To October 31st.

The awards made and the cultural details are as set out below:-

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Trestrail, S. J. ...	Karlgarin ...	Gluclub ...	36	9	8	14	14	81
Smith, W. G. ...	Kondinin ...	Ford ...	36	8	9	13	14	80
James, S. W. ...	Nth. Karlgarin	Gluyas Early	35	9	9	12	14	79
Treasure, C. W. ...	Karlgarin ...	Bencubbin ...	35	9	8	13	13	78
Parsons & Sons ...	Kondinin ...	Waratah ...	33	9	8	13	14	77
Grant, L. J. ...	Karlgarin ...	Gluyas Early	33	9	8	12	13	75
Repacholi, D. ...	Kondinin ...	Ford ...	34	8	7	13	13	75
McLennan, A. T. ...	Hyden Rock	Merredin ...	32	8	8	13	13	74
Biglin, E. J. & D. A.	Karlgarin ...	Geeralying ...	29	8	8	14	14	73
Clayton, R. G. ...	Hyden Rock	Gluyas Early	29	9	8	13	14	73
Green & Atkinson...	North Hyden Rock	Gluyas Early	29	9	9	13	13	73
Llewellyn, G. ...	Nth. Karlgarin	Gluyas Early	28	9	9	14	13	73
Davies, G. I. ...	Nth. Lake Carmody	Nabawa ...	29	9	9	12	13	72
Medcalf, G. E. ...	Karlgarin ...	Gluyas Early	29	9	9	12	13	72
Ray, J. G. ...	Nth. Karlgarin	Gluyas Early	29	9	7	13	14	72
Poole, H.	Karlgarin ...	Gluyas Late	27	9	9	13	13	71
Powell, P. L. ...	Karlgarin ...	Pusa ...	26	9	9	13	13	70
Fairclough, R. ...	Hyden Rock	Nabawa ...	26	9	9	13	12	69
Howlett, G. A. ...	Kondinin ...	Gluyas Late	28	7	8	13	13	69
Lynch, P. J. ...	Hyden Rock	Gluyas Early	26	9	8	13	13	69
Biglin, H. W. ...	Kondinin ...	Nabawa ...	25	8	8	13	14	68
Mourits, W. ...	Hyden Rock	Gluclub ...	27	8	8	12	13	68
Medcalf, C. W. ...	Karlgarin ...	Gluyas Early	25	9	7	12	13	66
Shalders, R. O. ...	Sth. Hyden Rock	Nabawa ...	21	8	9	13	12	63

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
						in.				lbs.	lbs.			
Trestrail, S. J.	5th crop	Salmon, gimlet, morrel, mallee	Early July	Good	Mouldboard	2½–3	Rigidtyne cultivated early Sept.; springtyne cultivated twice before seeding: harrowed just after seeding	Gluclub	1st June	45	90	Copper carbonate	Yes	Traces of Take-all and Flying Smut
Smith, W. G.	Old land	Salmon and gimlet	July–Aug.	Excellent	Mouldboard	4	Rigidtyne cultivated Sept.; planted with combined cultivator-drill with light drag-harrows attached	Ford	3rd week April	48	101	Copper carbonate	Yes	Traces of Take-all and Root-rot
James, S. W.	6th crop	Red morrel, gimlet, yorkgum	Early Aug.	Good	Disc ..	3	Disced 3in. deep early Sept.: springtyne cultivated just before drilling. Planted with combined cultivator drill	Gluyas Early	1st week June	30	60	Copper carbonate	Re-cleaned	Traces of Flag Smut
Treasure, C. W.	3rd crop	Salmon, gimlet, and mallee	July–Aug.	Good	Disc ...	3½	Disced 3in. deep late Aug. to early Sept: planted with combined cultivator-drill	Bencubbin	4th week May	38	90	Copper carbonate	Yes	Traces of Flag Smut in admixture. Take-all
Parsons & Sons	Old land	Salmon and gimlet	June-July	Good	Rigidtyne Scarifier	3	Rigidtyne cultivated Aug.-Sept.; springtyne cultivated April. planted with combined cultivator drill with light drag harrows attached	Waratah	1st week May	55	100	Copper carbonate	Yes	Traces of Ball Smut and Take-all
Grant, L. J.	3rd crop	Salmon, mallee, gimlet	June	Good	Disc ..	3	Disced 3in. deep July; Planted with combined cultivator-drill with light drag harrows attached	Gluyas Early	2nd June	34	72	Copper carbonate	Yes	Traces of Ball Smut and Take-all
Repacholi, D.	Old land	Salmon, gimlet, mallee	Early June, 1930	Good	Disc ..	3-4	Rigidtyne cultivated three times in Spring of 1930, and three times in Spring of 1931; planted with combined cultivator-drill with light drag harrows attached	Ford	1st week May	52	85	Copper carbonate	Yes	Traces of Ball Smut, Flag Smut, Take-all and Rootrot

CULTURAL DETAILS—*continued.*

Competitor.	No. of years cropped.	Timber.	When ploughed.	Condition of land.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
McLenna, A. T.	3rd crop	Salmon, gimlet, tea-tree	July	Fair	Disc ...	ins. 4	Disced 4in. deep Sept.; planted with combined cultivator-drill with light drag harrows attached	Merredin	20th May ...	lbs. 40	lbs. 60	Copper carbonate	Yes	Traces of Flag Smut, Flying Smut, and Take-all.
Higlin, E. J. & D. A.	2nd crop	Salmon and mallee	Sept.	Good	Rigid tyne scarifier	3	Springtyne cultivated in Oct. and again just before seeding	Geeralying	4th week May to 1st week June	45	60	Copper carbonate	Yes	Take-all.
Clayton, R. G.	3rd crop	Salmon, gimlet and mallee	July	Good	Disc ...	3	Disced 2in. deep Sept.; planted with combined cultivator-drill with light drag harrows attached	Gluyas Early	1st week May	45	60	Copper carbonate	Yes	Traces of Take-all and Flag Smut.
Green & Atkinkinson	1st crop	Salmon, gimlet, mallee	July	Very wet	Disc	3	Disced 3in. deep August; scrubby patches harrowed in April; springtyne cultivated in April; harrowed in May; planted with combined cultivator-drill	Gluyas Early	1st week June	36	100	Copper carbonate	Yes	Traces of Flag Smut.
Llewellyn, S.	3rd crop	Gimlet, salmon, jam, and mallee	June and August	Good	Disc	4	Springtyne cultivated in September and again just before seeding	Gluyas Early	Mid May ...	48	53	Copper carbonate	Yes	Traces of Take-all.
Davies, G. I.	1st crop	...	...	...	...	...	Springtyne cultivated in September and again just before seeding	Nabawa	End of April and early May	...	..	...	...	
Medcalf, G. E.	5th crop	Salmon and morrel	July	Good	Disc	2½	Springtyne cultivated in September; planted with combined cultivator-drill	Gluyas Early	Early May ..	45	75	Copper carbonate	Yes	Trace of Flag Smut.
Ray, J. G. ...	4th crop	Mallee, salmon, gimlet	July	Fair	Disc	3	Rigid-tyne cultivated just before seeding	Gluyas Early	4th week May	45	90	Copper carbonate	Yes	Little Flag Smut and trace of Take-all and Ball Smut.
Poole, H. ...	3rd crop	Gimlet, salmon, york gum, and morrel	Early July	Good	Disc	3	Disced 2in. deep in August; springtyne cultivated in August and again in September	Gluyas Late	1st fortnight May	50	80	Copper carbonate	Yes	Traces of Take-all and Ball Smut.

CULTURAL DETAILS—*continued.*

Competitor.	No. of years cropped.	Timber.	When ploughed.	Condition of land.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
						ins.				lbs.	lbs.			
Powell, P. L.	3rd crop	Salmon, gimlet, boree	August	Good	Disc	3	Springtyne cultivated in September; planted with combined cultivator-drill with light drag harrows attached	Pusa	4th week May	53	60	Copper carbonate	Yes	Trace of Take-all.
Fairclough, R.	1st crop	Gimlet, morrel, blackbutt, mallee	June	Good	Disc	3½	Harrowed in September; planted with combined cultivator-drill	Nabawa	1st week May	39	60	Copper carbonate	No	
Howlett, G. A.	5th crop	Salmon and gimlet	Sept.	...	Disc	4	Springtyne cultivated just before seeding	Gluyas Late	1st week May	45	63	Copper carbonate	Yes	Trace of Take-all.
Lynch, P. J. ...	3rd crop	Salmon, morrel, mallee	Sept.	Fair	Disc	3	Planted with combined cultivator-drill with light drag harrows attached	Gluyas Early	1st week May	45	60	Copper carbonate	Yes	Traces of Take-all and Flag Smut.
Biglin, H. W.	7th crop	Salmon and gimlet	June	Hard	Disc	3	Disced 3in. deep in August; springtyne cultivated in September and again at end of April after rain; planted with combined cultivator-drill with light drag harrows attached	Nabawa	2nd week May	50	90	Copper carbonate	No	Traces of Flying Smut and Take-all.
Mouritz, W. ...	2nd crop	Gimlet, salmon, mallee, morrel	June	Good	Disc	4	Disced 2in. deep August-September; springtyne cultivated in November; planted with combined cultivator-drill with light drag harrows attached	Gluclub	Mid-May ...	40	112	Copper carbonate	Yes	Trace of Ball Smut.
Medcalf, C. W.	3rd crop	Gimlet, salmon, mallee	July	Good	Disc	3	Springtyne cultivated in September and again just before seeding	Gluyas Early	1st week June	45	70	Copper carbonate	Yes	Ball Smut, Take-all.
Shalders, R. O.	3rd crop	Salmon gum	May	Good	Disc	3½	Disced 2in. deep in September; spring-cultivated just before seeding.	Nabawa	2nd week May	47	120	Copper carbonate	Yes	

HARRISMITH AGRICULTURAL SOCIETY.

The rainfall as recorded at Harrismith (Wedin) was as follows:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Harrismith (Wedin) ...	112	7	57	91	441	160	317	353	92	320	1,683	2	...	1,952

The awards and the cultural details are as set out below:—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Murray, A. ...	Tinkurrin ...	Canberra ...	25	9	8	14	14	70
Norton, J.	Tinkurrin ...	Bena ...	27	8	8	13	13	69
Black, L. J. ...	Tinkurrin ...	Waratah ...	25	8	8	11	13	65
McDonald, A. W. ...	Tinkurrin ...	Canberra ...	22	8	8	13	13	64
McKenzie, J. A. ...	Harrismith ...	German Wonder	16	8	7	13	12	56

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
						in.				lb.	lb.			
Murray, A. ...	4th crop	Salmon, morrel, manna gum, jam	July	Good	Mouldboard	3½–4	Portion springtyne cultivated in Oct.; portion springtyne cultivated in April, and remainder rigidtyne cultivated. Earlier planting drilled with combined cultivator drill with light drag harrows attached. Later planting skim-ploughed with mouldboard and planted with disc drill	Canberra	1st week June and end of June	55	90	Copper carbonate	Yes	Traces of Flag Smut and Flying Smut
Norton, J. ...	3rd crop	Sheoak, jam, york-gum, morrel	June-July	Good	Disc ...	3	Springtyne cultivated in March. Planted with combined cultivator drill, with light drag harrows attached	Bena	2nd week May	60	93	Copper carbonate	Re-cleaned	Take-all
Black, L. J. ...	Old land, 1st crop for 9 yrs.	Jam, salmon, morrel	Sept.	Patchy	Disc ...	4	Planted with combined cultivator drill	Waratah	Mid. June	50	90	Copper carbonate	Yes	Traces of Flag Smut and Flying Smut and a little Take-all
McDonald, W.	3rd crop	Jam, york gum, salmon	Aug.	Good	Mouldboard	3	Springtyne cultivated in September. Planted with combined cultivator drill with light drag harrows attached. Harrowed four days after planting	Canberra	3rd week June	...	90	Copper carbonate	Yes	Traces of Flying Smut, Take-all, and Ball Smut
McKenzie, J. A.	Old land	Morrel, salmon, jam	Aug.	Wet	Disc ...	3–4	Springtyne cultivated end of March. Planted with combined cultivator drill	German Wonder	End of April	50-55	90	Copper carbonate	Yes	Take-all, Traces of Rust and Septoria

KULIN AGRICULTURAL SOCIETY.

The rainfalls as recorded at the various centres were as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Kulin	81	2	64	231	340	115	352	379	246	338	1,770	...	...	2,148
Kulin Rock ...	60	...	34	85	300	144	275	387	125	371	1,602	5	...	1,786
Gnarming ...	105	3	67	91	271	121	309	377	143	314	1,535	3	...	1,804
F. S. Freebairn *	120	5	61	64	194	52	285	231	206	289	1,257	...	†	‡ 1,507
R. Purser & Co. *	125	...	61	85	259	84	297	297	144	217	1,298	2	†	‡ 1,571
A. W. Trotter * ...	60	3	64	82	262	103	310	346	152	313	1,686	...	†	‡1,895

* Unofficial. † Records not to hand. ‡ To November 30th.

The awards made and the cultural details are as set out below:—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Freebairn, F. S. ...	Jilakin ...	Gluclub ...	47	9	8	13	13	90
Trotter, A. W. ...	Kulin ...	Bena ...	41	8	9	14	13	85
Purser, R., & Co. ...	Jilakin ...	Gluclub ...	39	9	9	13	14	84
Scadding, N. A. ...	Jilakin ...	Gluclub ...	39	9	8	13	14	83
Bailey, G. A. ...	Kulin Rock...	Bena ...	37	8	8	14	13	80
Henderson, Mrs. F. F.	Gnarming ...	Queen Fan...	37	8	7	13	14	79
Meikle, P.	Kulin Rock...	Merredin ...	27	9	8	14	14	72
Nichols, R. ...	Kulin Rock...	Barootа Wonder Early	28	9	7	14	14	72
Bowey, P. J. ...	Kulin ...	Nabawa ...	28	8	8	14	12	70
Freebairn & Kemp	Kulin Rock...	Baroota Wonder Early	26	8	8	13	12	67

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
Freebairn, F. S.	3rd crop	Salmon, morrel, jam, blackbutt	March, 1931	Dry	Rigidtyne scarifier	in. 3½	Rigidtyne scarified early Sept.; hard portions springtyne cultivated in April. Planted with combined cultivator drill with light drag harrows attached. Fed off heavily during growing period.	Gluclub	1st week May	lb. 60	lb. 90	Copper carbonate	Yes	Flag Smut, trace of Take-all
Trotter, A. W	6th crop	Jam, yorkgum, morrel	July, 1930	Good	Disc ...	4	Springtyne cultivated late August, 1930, disced 3in. deep June, 1931. Springtyne cultivated just before seeding. Planted with combined cultivator drill with light drag harrows attached	Bena ...	9th–19th April	45	110	Bluestone..	Yes	Trace of Flag Smut
Purser, R. & Co.	3rd crop	Salmon, gimlet, jam, yorkgum, mallee	June	Good	Disc ..	3	Springtyne cultivated early Sept, and again early April. Planted with combined cultivator drill with light drag harrows attached	Gluclub...	2nd week May	50	100	Copper carbonate	Yes	Traces of Flying Smut and Flag Smut
Scadding, N. A.	3rd crop	Morrel, teatree	June	Good	Disc ...	3	Springtyne cultivated in Sept. and again just before seeding	Gluclub...	1st week May	60	85	Copper carbonate	Yes	Traces of Take-all and Flag Smut
Bailey, G. A.	1st crop	Jam, yorkgum, salmon	June	Good	Disc ..	3–4	Planted with combined cultivator drill	Bena ..	End of April	45	80	Copper carbonate	Yes	Traces Septoria and Flag Smut
Henderson, Mrs. F. F.	2nd crop	Yorkgum, jam, salmon, morrel	July	Good	Rigidtyne scarifier	2½	Harrowed early August; rigidtyne scarified early Oct.; springtyne cultivated early Nov. and again in March. Planted with combined cultivator drill and harrowed just after	Queen Fan	4th–15th May	43	112	Copper carbonate	Yes	Traces of Flag Smut, Take-all, Ball Smut and Septoria

CULTURAL DETAILS—*continued.*

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
Meikle, P. ..	Old land	Salmon, gimlet	June-July	Fair	Mouldboard	in. 3	Half mouldboard ploughed 2in. deep Sept.; remainder springtyne cultivated Sept., followed by harrowing in Oct. Planted with combined cultivator drill with light drag harrows attached	Merredin	Mid-May	lb. 40	lb. 95	Copper carbonate	Yes	Traces Flag Smut, Flying Smut & Take-all
Nichols, R. ...	9th crop	Gimlet, salmon, mallee	June	Good	Disc ...	3½	Disced 2in. deep in Aug.; springtyne cultivated Sept.; rigidtyne cultivated April. Planted with combined cultivator drill with light drag harrows attached	Baroota Wonder Early	1st–10th May	60	90	Copper carbonate	Yes	Traces Take-all, Flying Smut, Flag Smut, Ball Smut
Bowey, P. J.	Old land	Salmon, morrel	August	Fair	Rigidtyne scarifier	3	Springtyne cultivated April. Planted with combined cultivator drill	Nabawa	1st week May	50	75	Copper carbonate	Yes	Take-all, trace Septoria
Freebairn & Kemp	Old land	Salmon, mallee, morrel	June	Patchy	Disc ...	3	Rigidtyne cultivated Sept. and again middle April. Planted with combined cultivator drill with light drag harrows attached	Baroota Wonder Early	26th–30th April	60	70	Copper carbonate	Yes	Take-all, trace Flying Smut

LAKE GRACE AGRICULTURAL SOCIETY.

The rainfalls as recorded at Lake Grace, Burngup North, and Lake Biddy were as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Lake Grace ...	150	12	49	97	278	69	246	382	161	225	1,361	7	22	1,698
Burngup, North...	152	9	65	95	235	85	326	380	155	271	1,452	15	...	1,788
Lake Biddy ...	159	2	59	118	228	72	286	253	69	279	1,187	3	2	1,530

The awards made and the cultural details are as set out below:—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Stephens, F. ...	Sth. Lake Grace	Waratah ...	38	9	8	14	14	83
Bishop, H. J. ...	Lake Grace...	Waratah ...	36	9	8	13	14	80
Collinson & Fleay...	Burngup ...	Waratah ...	32	9	8	14	14	77
Woodburne, J. R. C.	Lake Grace...	Bena ...	32	9	8	13	13	75
Carruthers, H. F. ...	Lake Grace...	Waratah ...	30	8	9	13	13	73
Witham & Sons ...	Lake Biddy	Gluyas Late	28	9	9	13	13	72
Bishop, S. J. ...	Lake Grace...	Waratah ...	31	8	8	13	12	71
Lay, J.	Sth. Lake Grace	Gluyas Early	26	9	9	13	13	70

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
Stephens, F. ..	5th crop	Salmon and morrel	July	Good	Mouldboard	in. 2½–3	Springtyne cultivated mid-August and again mid-Sept.: disced 2in. deep before seeding. Planted with combined cultivator drill with light drag harrows attached	Waratah	3rd week May	lb. 40	lb 112	Copper carbonate	Yes	Trace Root Rot, Take-all
Bishop, H. J.	4th crop	Blackbutt	Late July	Good	Rigidtyne scarifier	2½	Rigidtyne scarified just before seeding. Planted with combined cultivator drill	Waratah	2nd week May	45	130	Copper carbonate	Yes	Traces of Take all and Flying Smut
Collinson & Fleay	3rd crop	Yorrel, morrel, salmon, boree, gimlet	July	Good	Disc ..	3	Springtyne cultivated just before seeding, light drag harrows attached to drill	Waratah	1st week May	33–35	100	Copper carbonate	No	Traces of Flag Smut and Flying Smut
Woodburne, J. R. C.	6th crop	Blackbutt, boree, morrel, yorrel	August	Good	Disc ...	3–3½	Drilled on surface and lightly covered with springtyne cultivator	Bena .	1st week May	58	Nil	Untreated	No	Traces of Take-all and Flag Smut
Carruthers, H. F.	Old land	Salmon and gimlet	June	Good	Disc ..	3	Disced 2in deep in Sept. and again in April. Planted with combined cultivator drill with light drag harrows attached	Waratah	1st week May	50	90	Copper carbonate	Yes	Trace of Take-all
Witham & Sons	6th crop	Salmon, yorkgum, gimlet	June	Good	Disc ...	3½	Springtyne cultivated Sept., disced 2in. deep just before seeding	Gluyas Late	Mid-May	45	80	Copper carbonate	No	
Bishop, S. J.	4th crop	Gimlet, yorrel, boree, salmon	July	Good	Disc ...	3	Springtyne cultivated in August, again in May and again in June just before seeding	Waratah	1st week June	45	112	Copper carbonate	Yes	Take-all
Lay, J. ...	Old land	Gimlet ...	Late June	Good	Disc ...	3	Disced 2in. deep late July and again late Sept. Springtyne cultivated just before seeding	Gluyas Early	2nd week June	52	90	Copper carbonate	Yes	Trace of Flag Smut

KUKERIN AGRICULTURAL SOCIETY.

The rainfall as recorded at Kukerin was as follows:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Kukerin	158	24	58	116	288	145	378	417	127	540	1,895	2	35	2,288

The awards made and the cultural details are as set out below:—

Awards.

Competitor.	Address.	Variety	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points	Total. 100 points.
English, C. ...	Sth. Kukerin	Yandilla King	36	9	8	13	14	80
Bahr, E. O. ..	Sth. Kukerin	Yandilla King	31	8	8	13	14	74
Nenke, B.	Kukerin .	Ford ..	29	9	9	13	13	73
Faulkner, W. J. ...	Kukerin ..	Gallipoli	29	8	9	13	13	72
Sugg Bros. ..	Kukerin ...	Nizam .	29	8	9	13	13	72
Troup, A.	Kukerin ...	Gallipoli ...	29	7	9	14	13	72
Williams, T. C. ..	Sth. Kukerin	Yandilla King	29	9	8	13	13	72
Smith, C. P.	Kukerin .	Gallipoli ..	29	7	9	14	12	71
Ditchburn, R. ..	Nth. Kukerin	Gallipoli ..	26	7	9	14	13	69
Joyce, F.	Nth. Kukerin	Sailor's Fortune	27	8	9	12	13	69
Datten Bros. ..	Kukerin ..	Bena ...	22	8	9	14	13	66
Smith, I.	Kukerin ..	Geeralying ..	19	8	9	13	12	61

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
English, C. ...	2nd crop	Salmon, jam, yorkgum	March, 1931	Dry	Rigidtyne scarifier	in. 2	Skim ploughed with mouldboard 2in. deep June; rigidtyne scarified in August; half springtyne cultivated in January after rain; whole rigidtyne scarified in April	Yandilla King	1st week May	lb. 43	lb. 80	Copper carbonate	Yes	Little Take-all
Bahr, E. O....	Old land	Yorkgum, manna and salmon gum, morrel, mallee	July	Good	Mouldboard	3	Springtyne cultivated in Sept.; planted with combined cultivator drill; harrowed just after seeding	Yandilla King	End of April	40	70	Copper carbonate	Yes	Take-all and trace of Root-rot
Nenke, B. ...	3rd crop	Salmon and gimlet	August	Good	Mouldboard	3½	Springtyne cultivated in Sept., and again just before seeding	Ford ...	1st week June	42	90	Copper carbonate	Yes	Trace of Take-all
Faulkner, W. J.	Old land	Salmon and morrell	Sept.	Wet	Mouldboard	3	Mouldboard ploughed 2in. deep just before seeding. Planted with combined cultivator drill; harrowed just after seeding	Gallipoli	3rd week June	55	90	Formalin	No	Trace of Take-all
Sugg Bros. ...	Old land	Salmon and mallee	July	Good	Disc ..	3	Springtyne cultivated in Sept.: weedy portions springtyne cultivated in May. Planted with combined cultivator drill	Nizam ...	End of May	45	90	Copper carbonate	Yes	Trace of Root-rot
Troup, A. ...	Old land	Morrel, salmon, mallee	July	Good	Mouldboard	3	Mouldboard ploughed 3in. deep in March; portion disced 2in. deep in April and remainder mouldboard ploughed in May	Gallipoli	Mid-May	55	90	Copper carbonate	Yes	
Williams, T. C.	3rd crop	Salmon, morrel, mallee	June	Good	Disc ...	3	Disced 3in. deep late Aug.; springtyne cultivated 2in. deep late Sept., again in October and again just before seeding. Planted with combined cultivator drill	Yandilla King	2nd week May	40	112	Copper carbonate	Yes	Take-all

CULTURAL DETAILS—*continued.*

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
						in.				lb.	lb.			
Smith, C. P....	Old land	Salmon and morrel	July	Good	Disc ...	2	Sprintgyne cultivated in Sept. and again just before seeding. Planted with combined cultivator drill	Gallipoli	Mid-May	45	80	Copper carbonate	Yes	
Ditchburn, R.	Old land	Salmon, morrel, mallee	July	Good	Mouldboard	3	Disced 2in.-2½in. deep April; planted with combined cultivator drill	Gallipoli	Mid-May	70–75	90	Copper-carbonate	Re-cleaned	Trace of Take all
Joyce, F. ...	Old land	Salmon, morrell, gimlet, mallee	August	Fair	Mouldboard	3	Mouldboard ploughed 2in. deep in Sept., and again just before seeding; harrowed just after drilling	Sailor's Fortune	1st week June	45	60	Formalin ...	Yes	Trace of Ball Smut
Daffen Bros....	Old land	Salmon and morrel	August	Good	Disc ...	4	Disced 2in. deep in Sept. and again in October; springtyne cultivated just before seeding	Bena ..	1st week May	50	75	Copper carbonate	Yes	Trace of Take-all
Smith, I. ...	old land	Morrel and mallee	July	Good	Mouldboard	4	Rigidtyne cultivated in October and again at end of March after rain; planted with combined cultivator drill	Geeralying	3rd week June	50	105	Copper carbonate	Yes	

ROYAL AGRICULTURAL SOCIETY.

Only one competitor, viz., J. R. Bremner & Sons, of Corrigin, in this zone, entered direct with the parent body.

The rainfall as recorded at Corrigin was as follows:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Corrigin	52	...	46	75	380	119	358	411	133	390	1,791	...	14	1,978

The awards made and the cultural details are as set out below:—

Awards.

Competitor.	District.	Society.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Bremner, J. R., & Sons	Corrigin ...	Royal ...	Waratah	32	9	7	14	13	75

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.
Bremner, J. R. & Sons	5th crop	Gimlet, salmon, mallee	March, 1931	Dry but friable	Rigidtyne scarifier	in. 3	Rigidtyne cultivated in June; springtyne cultivated in August and again in Sept. Planted with combined cultivator drill. Harrowed immediately after seeding.

Competitor.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
Bremner, J. R. & Sons ...	Waratah	1st week May	lb. 45	lb. 100	Copper carbonate	Yes	Flag Smut and traces of Flying Smut and Take-all

ZONE 8.

Judge—N. Davenport, Agricultural Adviser.

Royal Society—2 competitors.

Wickepin Society—5 competitors.

Gnowangerup Society—13 competitors.

Total—20 competitors.

WICKEPIN AGRICULTURAL SOCIETY.

The rainfall as recorded at Wickepin was as follows:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	J .	July.	Aug.	Sep.	Oct.	Total.			
Wickepin ...	130	...	75	179	464	164	414	423	78	334	1,877	1	7	2,269

The awards made and the cultural details are as set out below:—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Fleay, C.	Wickepin ...	Graham ...	37	9	8	13	13	80
Elliott Bros. ...	Cliffordville...	Free Gallipoli	35	9	8	14	13	79
Hosken Bros. ...	Wickepin ...	Free Gallipoli	28	8	8	13	12	69
Miller, G.	Wickepin ...	Improved Rajah	21	8	8	14	12	63
Clifford, M. ...	Cliffordville...	Waratah ...	16	7	9	14	11	57

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
						in.				lb.	lb.			
Fleay, C. ...	New land	Yorkgum, manna, morrel	August	Wet	Mouldboard	4	Planted with combined cultivator drill	Graham	1st week May	50	61	Copper carbonate	Yes	Take-all
Elliott Bros....	3	Yorkgum & jam	Early July	Good	Mouldboard	3-4	Springtyne cultivated Oct. and prior to drilling. Planted with disc drill	Free Gallipoli	3rd week April	45	90	*Nil* ...	Yes	Take-all and Flag Smut
Hosken Bros.	Old land	Morrel and mallee	Early July	Good	Mouldboard	4	Springtyne cultivated Sept. and April. Planted with combined cultivator drill with light harrows attached	Gallipoli	1st week May	60	112	Formalin	Yes	Little Take-all
Miller, G. ...	Old land	Morrel and mallee	July	Good	Disc ...	4½-5	Springtyne cultivated Oct. and twice in April. Planted with combined cultivator drill with light harrows attached	Improved Rajah	3rd week May	60	110	Copper carbonate	Re-cleaned	Take-all
Clifford, M. ...	2	Yorkgum and jam	Sept.	Boggy	Mouldboard	4	Springtyne cultivated prior to planting with disc drill	Waratah	End April	60	90	Copper carbonate	Yes	Flag Smut

GNOWANGERUP AGRICULTURAL SOCIETY.

The rainfalls as recorded at Gnowangerup and Borden were as follows:—
follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Gnowangerup ...	138	27	71	169	202	203	362	198	133	224	1,412	42	8	1,867
Borden	118	93	59	151	185	218	270	206	175	209	1,263	3	15	1,702

The awards made and the cultural details are as set out below:—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total 100 points.
Cockram, C. E. ..	Gnowangerup	Free Gallipoli	45	9	9	14	14	91
McDonald, J. ...	Gnowangerup	Bencubbin ...	42	9	9	14	14	88
Stewart, W. B. ...	Gnowangerup	Yandilla King	40	9	8	14	14	85
Wellard & Wellard	Gnowangerup	Yandilla King	38	8	8	14	13	81
Beeck, H. O. ...	Gnowangerup	Yandilla King	37	9	9	14	12	81
Davis, N. P. ...	Gnowangerup	Yandilla King	35	9	9	14	14	81
Murray, G. ...	Borden ...	Yandilla King	34	9	8	14	13	78
Mianelup Estate ...	Gnowangerup	Nabawa ...	30	8	8	14	13	73
White, R. H. ...	Pallinup ...	Yandilla King	29	9	8	14	13	73
Gaze, W. O. ...	Kebaringup	Nabawa ...	29	9	8	14	13	73
Wright, E. H. ...	Pallinup ...	Yandilla King	28	9	9	14	13	73
White, A. J. ...	Pallinup ...	Yandilla King	28	9	9	14	12	72
Formby, R., & Co.	Gnowangerup	Yandilla King	29	8	8	14	12	71

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
Cockram, C. B.	Old land	York gum	Late June	Good	Mouldboard	in. 3	Springtyne cultivated Aug., late Sept., and end April. Planted with combined cultivator drill with light harrows attached	Free Gallipoli	1st week June	lb. 55	lb. 112	Copper carbonate	Yes	Trace Take-all
McDonald, J.	Old land	Salmon and yorkgum	July	Good	Mouldboard	3½	Springtyne cultivated late Sept., and early Oct., and harrowed; Springtyne cultivated again during Feb., and April after rain and prior to seeding with combined cultivator drill with light harrows attached	Ben-cubbin	4th week June	55	100	Copper carbonate	Yes	Trace of Rust
Stewart, W. B.	Old land	Yorkgum and morrel	Late June	Good	Mouldboard	3	Springtyne cultivated 1st week Sept., mid Oct., mid Dec., and mid April. Planted with combined cultivator drill with light harrows attached	Yandilla King	last week May	48	120	Vitrioline	Yes	Take-all
Wellard & Wellard	Old land	Salmon and manna gum	Late Aug.	Fair	Mouldboard	3	Disc cultivated end Sept. Springtyne cultivated April and prior to seeding. Planted with combined cultivator drill with light harrows attached	Yandilla King	3rd week May	45	90	Copper carbonate	Yes	Take-all and Rust
Beeck, H. O.	Old land	Salmon and manna gum	Late Aug.	Good	Mouldboard	3	Cultivated with rigidtyne scarifier 3in. deep in July prior to ploughing. Harrowed early Aug.; cultivated with rigidtyne scarifier end Oct., and with springtyne cultivator early May. Planted with combined cultivator drill with light harrows attached	Yandilla King	1st week June	45	80	Copper carbonate	Yes	Take-all

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
						in.				lb.	lb.			
Davis, N. P.	Old land	Yorkgum and morrel	July	Good	Mouldboard	3–3½	Springtyne cultivated early Oct., and in Autumn after rain. Planted with combined cultivator drill	Yandilla King	1st week June	35	112	Copper carbonate	Yes	Take-all and trace Rust
Murray, G. ...	2	Morrel	Late July	Fair	Mouldboard	3–4	Springtyne cultivated Sept., Nov., and April. Planted with combined cultivator drill	Yandilla King	last week May	52	96	Copper carbonate	Yes	Take-all
Mianelup Estate	Old land	Poot	June	Good	Disc ...	4	Disc cultivated end Sept. and springtyne cultivated shortly after and again in April. Planted with combined cultivator drill with light harrows attached	Nabawa	1st week June	60	110	Copper carbonate	Yes	Take-all
White, R. H.	Old land	Morrel	June	Good	Mouldboard	4	Springtyne cultivated end Aug., Sept., Oct., and April. Planted with combined cultivator drill with light harrows attached	Yandilla King	last week May	55	112	Copper carbonate	Yes	Take-all
Gaze, W. O.	Old land (lucerne pasture)	Yorkgum, morrel and mort	July	Hard	Disc ..	4–5	Disc cultivated Jan., after 2in. rain. Springtyne cultivated Feb. Planted with combined cultivator drill	Nabawa	3rd week June	52	90	Copper carbonate	Yes	Take-all and trace loose Smut
Wright, E. H.	New land	Yorkgum and morrel	July	Good	Disc cultivating plough	2½–3	Cross worked with disc cultivating plough end Sept. Springtyne cultivated March. Planted with combined cultivator drill with light harrows attached	Yandilla King	Mid-May	50	80	Copper carbonate	Yes	Trace Take-all and Rust
White, A. J.	Old land	Morrel and yorkgum	July–Aug.	Fair	Mouldboard	4	Springtyne cultivated Oct. and early May. Planted with combined cultivator drill with light harrows attached	Yandilla King	4th week May	50	90	Copper carbonate	Yes	Take-all
Formby, R. & Co.	Old land	Salmon gum and little mort	July	Fair	Mouldboard	3½	Springtyne cultivated early Oct. and April. Planted with combined cultivator drill with light harrows attached	Yandilla King	3rd week May	47	85	Copper carbonate	Yes	Take-all and Rust

ROYAL AGRICULTURAL SOCIETY.

The rainfalls as recorded at South Caroling and Borden, the location of the two competitors entering direct with the above Society, were as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
South Caroling ...	16	...	23	63	488	115	351	392	79	502	1,927	...	8	2,032
Borden	118	93	59	151	185	218	270	206	175	209	1,263	3	15	1,702

The awards made and the cultural details are as set out below:—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Richards, A. ...	Sth. Caroling	Gluclub ...	41	9	9	13	13	85
Illawarra Co. ...	Borden ...	Nabawa ...	34	9	9	14	14	80

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.
Richards, A. ...	Old land	York gum, gimlet and morrel	June	Good	Mouldboard	in. 3½–4	Springtyne cultivated Sept. and Oct., followed by harrows; planted with combined cultivator drill
Illawarra Pastoral Co.	Old land	Morrel	July	Good	Mouldboard	4	Disc cultivated Oct. Springtyne cultivated Mar., after rain, and again prior to seeding Planted with hoe drill

Competitor.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
Richards, A. ...	Gluclub	1st week June	lb. 52	lb. 120	Copper carbonate	Yes	
Illawarra Pastoral Co.	Nabawa	3rd week June	60	140	Copper carbonate	Yes	Trace Take-all

ZONE 9.

Judge—L. G. Seinor, Manager Salmon Gums Experiment Farm.

Southern Mallee Society—23 competitors.

Phillips River Society—5 competitors.

Total—28 competitors.

SOUTHERN MALLEE AGRICULTURAL SOCIETY.

The rainfalls as recorded at the respective centres were as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Scaddan	·81	22	145	355	56	233	153	277	165	238	1,122	25	44	1,794
Grass Patch ...	71	9	119	129	73	213	150	216	83	321	1,056	65	43	1,492
Red Lake ...	67	14	107	141	137	176	116	185	78	326	1,018	44	37	1,428
Circle Valley ...	55	11	111	112	76	159	147	187	78	361	1,008	29	45	1,371
Salmon Gums ...	52	13	88	79	89	152	149	197	77	326	990	21	60	1,308
Dowak	50	14	92	91	142	127	152	179	53	310	963	34	57	1,301
Kumarl	61	11	106	†	112	128	163	197	40	341	981·	†	†	*1,159

* Total to 31st October, excluding April. † Returns not available.

The awards made and the cultural details are as set out below:—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Haywood, T. ...	East Dowak	Gluyas Early	34	9	9	14	14	80
Clarke, A. T. ...	East Dowak	Gluyas Early	33	9	9	14	14	79
Maidment, A. ...	Salmon Gums	Gluyas Early	27	9	8	13	13	70
Talcon & Vosnacos	Salmon Gums	Gluyas Early	27	9	9	12	13	70
Sharpe, H. ...	Treslove ...	Nabawa ...	26	8	8	14	13	69
Johnston, J. ...	West Dowak	Gluyas Early	25	8	9	13	14	69
Grigg Bros. ...	Scaddan ...	Bencubbin ...	26	8	8	13	13	68
McCrea, N. J. ...	East Dowak	Gluyas Early	24	9	8	14	13	68
McCrea, W. F. ...	East Dowak	Noongaar ...	24	9	9	13	13	68
Thomas Bros. ...	Salmon Gums	Gluyas Early	23	8	9	13	13	66
Richie, D.	Grass Patch	Nabawa ...	24	8	8	13	12	65
O'Keefe, M. ...	West Dowak	Gluyas Early	24	8	9	12	12	65
Flintham, C. ...	Scaddan ...	Nabawa ...	23	8	8	13	13	65
Bassett, J. ...	Salmon Gums	Gluyas Early	23	8	9	12	13	65
Patterson, R. ...	Scaddan ...	Nabawa ...	23	8	8	12	13	64
Dunne, T.	Kumarl ...	Noongaar ...	19	9	9	13	14	64
Webster, J. ...	Treslove ...	Gluyas Early	22	8	8	13	12	63
Dowling, C. F. ...	Grass Patch	Gluyas Early	21	8	8	13	13	63
McCosh, J. ...	Kumarl ...	Gluyas Early	23	7	8	12	12	62
Waters, T. ...	West Dowak	Gluyas Early	21	8	8	12	12	61
Sedgwick, N. ...	Red Lake ...	Nabawa ...	19	8	8	13	13	61
Chapman, F. ...	West Dowak	Gluyas Early	19	8	9	13	12	61
Cooksey, F. ...	Beete ...	Gluyas Early	20	8	8	13	12	61

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent cultivations.	Variety.	When planted.	Rate of seed.	Rate of super.	Seed treatment	Graded.	Disease.
						in.					lb.	lb.		
Haywood, T.	New land	Silver bark, salmon and gimlet	July	Good	Disc	3–4	Springtyne cultivated ahead of drill	Gluyas Early	1st week May	39	93	Dry	Yes	No
Clarke, A. E. F.	New land	Merrit and gimlet, mallee	Oct., and Nov.	Dry	Disc	3	Cultivated ahead of drill	Gluyas Early	2nd week May	45	90	Dry	No	No
*Maidment, A.														
Talcon and Vosnacos	New land	Whipstick and gimlet, mallee	July	Good	Disc	3–4	Springtyne cultivated ahead of drill	Nabawa	Middle May	45	112	Dry	Yes	Flag Smut
Grigg Bros.	New land	Light mallee and scrub	June–July	Good	Disc	3–4	Cross ploughed ahead of drill at seeding time	Bencubbin	Early May	45	100	Dry	Yes	Rust
Sharpe, H. ...	New land	Light scrub and mallee	July	Good	Disc	3–4	Cross cultivated in April, and again ahead of drill	Nabawa	Early May	45	83	Dry	No	Rust and Flag Smut
Johnston, J. F.	New land	Gimlet and silver bark	June	Good	Disc	3–4	Cross ploughed and cultivated ahead of drill	Gluyas Early	Middle May	40	90	Dry	No	No
McCrea, N. J.	1st crop	Silver bark and gimlet	June–July	Good	Disc	3–4	Cultivated ahead of drill	Gluyas Early	May	40	90	Dry	Yes	
Flintham, C. B.	New land	Black mallee and light scrub	June–July	Good	Disc	3–4	Cross cultivated ahead of drill	Nabawa	Early May	55	90	Dry	No	Rust
McCrea, W. F.	2nd crop	Silver bark	July	Good	Disc	3–4	Cultivated ahead of drill	Noongaar	May	45	90	Dry	Yes	
Richie, D. ...	New land	Silver bark and mallee	Aug.	Good	Disc	3–4	Cross ploughed ahead of drill	Nabawa	15th May	45	112	Dry	Yes	Rust
Patterson, A. B.	New land	Light mallee	July	Good	Disc	3–4	Cross ploughed ahead of drill	Natawa	Early May	45	95	Dry	Yes	
Cooksey, F. ...	New land	Black mallee	Aug.	Fair	Disc	3–4	Cultivated ahead of drill	Gluyas Early	Middle May	45	90	Dry	Yes	

* Particulars not available.

CULTURAL DETAILS—*continued.*

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
McCosh, J. ...	New land	Blackbutt and gimlet	June–July	Good	Disc	in. 3–4	Cross ploughed ahead of drill	Gluyas Early	Middle May	45	lb. 100	lb. Dry	Yes	
Webster, J. ...	New land	Light mallee	June	Good	Disc	3–4	Cultivated ahead of drill	Gluyas Early	15th May	45	80	Dry	Yes	
Bassett, J. ...	New land	Mallee and silver bark	June	Good	Disc	3–4	Harrowed and cultivated in Sept. and Oct., and ahead of drill	Gluyas Early	Middle May	45	90	Dry	Yes	
Thomas Bros.	New land	Silver bark and mallee	July	Good	Disc	3–4	Cultivated Feb., and again ahead of drill	Gluyas Early	April	45	90	Dry	Yes	
O'Keefe, M. ...	New land	Mallee, merrit, tea-tree	July	Good	Disc	3–4	Ploughed ahead of drill	Gluyas Early	Middle May	45	90	Dry	Yes	Flag Smut
Dowling, C. F.	New land	Tea-tree, and black mallee	July	Good	Disc	3–4	Cross sundercut ahead of drill	Gluyas Early	Middle May	45	80	Dry	No	
Waters, T. ...	2nd crop	Silver bark	June-July	Good	Disc	3–4	Cultivated and harrowed October and harrowed ahead of drill	Gluyas Early	15th May May	45	80	Dry	Yes	
Sedgwick, N.	New land	Whitegum and scrub	August	Dry	Disc	4	Cross ploughed ahead of drill	Nabawa	1st May	45	85	Dry	No	Flag Smut
Dunne, T. ...	New land	Gimlet, merrit and tea-tree	June	Good	Disc	3–4	Cultivated September and harrowed ahead of drill	Noongaar	Middle May	45	90	Dry	Yes	
Chapman, F.	New land	Mallee and silver bark	July	Good	Disc	3–4	Cultivated ahead of drill	Gluyas Early	Middle May	42	60	Dry	Yes	

PHILLIPS RIVER AGRICULTURAL SOCIETY.

The rainfall as recorded at Ravensthorpe was as follows:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Ravensthorpe ...	147	77	113	193	206	198	145	235	167	430	1,381	62	7	1,980

The awards made and the cultural details are as set out below:-

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Love, W. J. ...	Ravensthorpe	Ford ...	35	9	9	14	14	81
Campbell, J. ...	Ravensthorpe	Gluyas Early	29	8	9	13	13	72
Barrett Bros. ...	Ravensthorpe	Noongaar ...	23	8	8	13	13	65
Bebbington Bros. ..	Ravensthorpe	Gluyas Early	22	8	8	12	12	62
Chamber Bros. ...	Ravensthorpe	Merredin ...	21	7	8	13	12	61

CULTURAL DETAILS

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Disease.
						in.								
Love W. J. ...	3rd year	Heavy salmon gum	June–July	Good	Mouldboard	3–4	Springtyne cultivated August and ahead of drill	Ford	1st week May	38	65	Dry	Yes	No
Campbell, J....	2nd year	Jam, salmon gum and wattle	June	Good	Mouldboard	3–4	Springtyne cultivated March and again ahead of drill	Gluyas Early	Last week May	45	90	Dry	Yes	Flag Smut
Barrett Bros.	...	Salmon gum and mallee	June	Good	Disc	3–4	Springtyne cultivated August and Sept., and ahead of drill	Noongaar	1st week June	50	112	Dry	Yes	
Bebbington Bros.	...	...	June–July	Good	Mouldboard	3–2		Gluyas Early	May	45	100	Dry	Yes	
Chamber Bros.	3rd crop	Mallee and gimlet	July	Good	Mouldboard	3–4	Springtyne cultivated August and again ahead of drill	Merredin	Early May	45	65	Dry	Yes	

ROYAL AGRICULTURAL SOCIETY—ZONE CHAMPIONSHIP AWARDS.

Representatives from District Agricultural Societies' Competitions and entries received direct by the Royal Agricultural Society:—

Competitor.	Address.	Society.	Variety.	Yield.	Freedom from weeds.	Freedom from disease.	Freedom from admixture.	Evenness of growth.	Total.
				50 pts.	10 pts.	10 pts.	15 pts.	15 pts.	100 pts.
ZONE 1.—Judge F. L. SHIER, Agricultural Adviser.									
Forrister, J. K....	Carnamah ...	Carnamah ...	Gluyas Early	40	8	9	14	14	85
Hebiton, J. K. ...	Three Springs	Three Springs	Bena ...	37	9	9	13	14	82
Morecombe, P. T.	Coorow ...	Carnamah ...	Gluyas Early	34	9	9	13	13	78
Lynch, Senator P.	Mt. Leonora	Three Springs	Glucub ...	34	8	9	13	13	77
ZONE 2.—Judge J. H. LANGFIELD, Manager, Merredin Experiment Farm.									
Butcher, O ...	Dalwallinu ..	Dalwallinu ...	Gluclub ...	42	9	9	13	14	87
Moore, T. ...	Indarra ...	Royal ...	Bencubbin ...	39	9	10	14	14	86
Locke, T. C. ...	Dalwallinu ...	Dalwallinu ...	Bencubbin ...	36	8	10	14	13	81
ZONE 3.—Judge N. DAVENPORT, Agricultural Adviser.									
Mt. Rupert Co. ...	Wongan Hills	Royal ...	Merredin ...	37	9	8	14	14	82
Jones, W. W. ...	Cowcowing ...	Royal ...	Bencubbin ...	36	9	9	14	13	81
Lane, W. H. & V. R.	Wongan Hills	Royal ...	Ford ...	34	8	8	13	13	76
Woodfield, N. H. C.	Goomalling...	Royal ...	Bena ...	31	9	8	14	12	74
ZONE 4.—Judge: G. L. THROSSELL, Agricultural Adviser,									
Creagh, Bros. ...	Kwelkan ...	Nungarin ...	Gluyas Early	33	9	8	13	13	76
Evans, L. D. ...	Nukarni ...	Nungarin ...	Bencubbin ...	30	9	8	14	13	74
Hopwood, B. W. G.	Bencubbin ...	Mt. Marshall	Bencubbin ...	27	8	8	14	13	70
Smith, P. J. ..	Turkey Hill	Southern Cross	Noongaar ...	22	8	8	13	13	64
Stevens, G. K. ...	Ghooli ..	Southern Cross	Bencubbin ...	18	9	9	14	12	62
Thompson, M. A.	Bencubbin ...	Mt. Marshall	Gluyas Early	17	7	6	14	11	55
ZONE 5: Judge R. P. ROBERTS, Agricultural Adviser.									
Kay, J.	Baandee ...	Merredin ...	Gluclub ...	40	8	8	12	14	82
Smith & Sons ...	Bungulluping	Bruce Rock	Gluclub ...	37	9	9	13	13	81
Teasdale, F. O. ...	Korbel ...	Merredin ...	Bencubbin ...	36	8	8	14	13	79
Hammond, J. D.	Kellerberrin	Royal ...	Bencubbin ...	30	8	8	14	13	73
Smith, C. & A. H.	Yalbarrin ...	Bruce Rock	Gluclub ...	32	8	7	13	13	73
ZONE 7.—Judge: A. S. WILD, Agricultural Adviser.									
Freebairn, F. S....	Jilakin ...	Kulin ...	Gluclub ...	47	9	8	13	13	90
Trotter, A. W. ...	Kulin ...	Kulin ...	Bena ...	41	8	9	14	13	85
Stephens, F. ...	South Lake Grace	Lake Grace...	Waratah ...	38	9	8	14	14	83
Trestrail, S. J. ...	Karlgarin ...	Karlgarin ...	Gluclub ...	36	9	8	14	14	81
Bishop, H. J. ...	Lake Grace...	Lake Grace...	Waratah ...	36	9	8	13	14	80
English, C. ...	Sth. Kukerin	Kukerin ...	Yandilla King	36	9	8	13	14	80
Smith, W. G. ...	Kondinin ...	Karlgarin ...	Ford ...	36	8	9	13	14	80
Bremner, J. R. & Sons	Corrigin ...	Royal ...	Waratah ...	32	9	7	14	13	75
Bahr, E. O. ...	Sth. Kukerin	Kukerin ...	Yandilla King	31	8	8	13	14	74
Murray, A. ...	Tinkurrin ...	Harrismith ...	Canberra ...	25	9	8	14	14	70
Norton, J. ...	Tinkurrin ...	Harrismith ...	Bena ...	27	8	8	13	13	69
ZONE 8.—Judge: N. DAVENPORT, Agricultural Adviser.									
Cockram, C. E. ...	Gnowangerup	Gnowangerup	Free Gallipoli	45	9	9	14	14	91
McDonald, J. ...	Gnowangerup	Gnowangerup	Bencubbin ...	42	9	9	14	14	88
Richards, A. ...	Sth. Caroling	Royal ...	Gluclub ...	41	9	9	13	13	85
Illawarra Co. ...	Borden ...	Royal ...	Nabawa ...	34	9	9	14	14	80
Fleay, C. ...	Wickepin ...	Wickepin ...	Graham ...	37	9	8	13	13	80
Elliott Bros. ...	Cliffordville...	Wickepin ...	Free Gallipoli	35	9	8	14	13	79
ZONE 9.—Judge: L. G. SEINOR, Manager, Salmon Gums Experiment Farm.									
Love, W. J. ...	Ravensthorpe	Phillips River	Ford ...	35	9	9	14	14	81
Haywood, T. ...	E. Dowak ...	Southern Mallee	Gluyas Early	34	9	9	14	14	80
Clarke, A. T. ...	E. Dowak ...	Southern Mallee	Gluyas Early	33	9	9	14	14	79
Campbell, J. ...	Ravensthorpe	Phillips River	Gluyas Early	29	8	9	13	13	72

OBJECTS OF THE COMPETITION.

The object of the competition is the improvement of the standard of wheat farming methods practised throughout the wheat belt. A spirit of healthy rivalry is engendered and competitors and others set themselves to follow those more successful than themselves. The methods practised by all the competitors are tabulated, the good farmers of the State receive recognition of their ability, and consequently a standard of practical wheat farming is established. It is demonstrated that, where recommended methods are employed, reasonable success follows. The competitions also afford the officers of the Department of Agriculture opportunities to come into personal contact with the farmers.

THE SEASON.

The opening of the 1932 season was an unfavourable one. After general rains of a rather light nature in mid-April registrations were not again general until the end of May. The opening rains were not sufficient for a complete moistening of the seed bed and upper subsoil, and owing to the particularly prolonged dry spell which followed germination of the early sown crops was patchy, and in some cases malting occurred.

The greater proportion of the crops was seeded dry, and for this reason weed control was not as effective as was desired. After the late May rains germination was good, and the growing season continued satisfactorily as the result of good general falls during the winter months.

There occurred from July onwards, and especially in the outer drier areas, a series of frosts which in these districts in many cases caused considerable damage.

General rains continued into October, and these were very beneficial in all districts. As the result of the late start and these late rains the season ended a fortnight or so later than usual.

ENTRIES.

The total number of crops competing for the zone championship awards in the different zones was 168, a considerable increase over the number of entries for the previous year, viz., 110.

Entries were received from 17 District Agricultural Societies and 9 entries were received direct by the Royal Agricultural Society. In addition, local competitions were conducted by the Bruce Rock and Phillips River Agricultural Societies, and also by the Wialki-Bonnie Rock Settlers' Association. These local competitions included 19 competitors, making a total of 187 crops inspected in all.

The following table shows the progress of the competition since its inception in 1921:—

Year.	No of District Agricultural Societies competing.	No. of competitors.	Average Yield of competitors.	Average Yield for State.
			bush.	bush.
1921	...	15	25	10·4
1922	...	32	24	8·9
1923	12	82	29	11·4
1924	15	70	31	12·8
1925	18	59	22·5	9·7
1926	11	99	24·5	12·0
1927	10	100	26·9	12·1
1928	13	114	22·5	10·1
1929	12	156	21·7	11·0
1930	15	165	27·4	13·3
1931	13	110	27·4	13·1
1932	17	168	29·3	11·4*

* Estimate. District Agricultural Societies did not compete until 1923.

It will be seen from the above table that absolute records for the number of competing societies and number of competitors were established, while the average yield of all competitors, viz., 29.3 bushels per acre, has been bettered on one occasion only, viz., in 1924, when an average of 31 bushels was obtained.

Varieties.

This year the pride of place for the favourite variety has been won by the standard variety Gluyas Early, being planted by 42 competitors. Nabawa comes next and was planted by 16. The previous year the position was reversed, the numbers being Nabawa 31, Gluyas Early 13. This is to some extent due, no doubt, to the late germination of the crops with the consequent handicap to the later maturing varieties. The figures for the remaining varieties are Bencubbin 14, which appears to be fast displacing Nabawa in this respect, Gluclub 14, Yandilla King 12, Merredin, Bena, and Waratah with 9 each, Noongar 8, Free Gallipoli 7, Ford 5, Gluyas Late 4, Geeralying 3, Carrabin, Pusa, Canberra, and Baroota Wonder Early with 2 each, and Felix, S.H.J., German Wonder, Nizam, Sailor's Fortune, Queen Fan, Graham, and Improved Rajah were represented by one competitor each.

It will be seen that the standard recommended varieties were entered by the majority of competitors.

Three zone championships were won by the variety Gluclub, two with Gluyas Early, and one each with Merredin, Free Gallipoli, and Ford.

The variety Gluclub established a State record yield of 47 bushels per acre, and which had previously been held by the variety Yandilla King with a yield of 46 bushels per acre.

Time of Seeding.

This is one of the most important factors for the successful production of the wheat crop. The seeding season is a comparatively short one, and as it is known that some varieties are more suitable for early planting, others for mid-season, and others again for late planting, the seeding operations should be so arranged that the varieties selected are planted as near as possible to their optimum, *i.e.*, best seeding period.

The effect of seeding out of season was not so marked for the past crop inasmuch as the main germination took place at the end of May and in early June, due to the long dry spell during the main seeding month of May. It must be borne in mind that last season was quite an abnormal one, and farmers should not deviate from the calendar based on the expectations over a number of years.

75 per cent. of the crops were planted in May and 5 per cent. in April.

The late sown crops were located chiefly in the heavier rainfall districts where the seeding period is later and where rainfall during the spring months is more plentiful.

Of the 168 crops in the competition, 22 were late maturing varieties, 76 were mid-season varieties, and the remaining 70 were of early and very early maturing varieties.

Rates of Seeding.

The rates of seeding varied from 24 lbs. to 75 lbs. per acre, with an average of 47 lbs. The majority of the competitors planted between the rates of 45 lbs. and 60 lbs. per acre.

Experimental results indicate that for the mid-season and early districts, while the yield is not decreased by heavier rates of seeding, no advantage is gained by increasing the amount over 45 lbs. per acre. In the very early districts, however, the lighter rates of seeding are more suitable. For the late, *i.e.*, heavy rainfall districts, heavier rates can be practised often with advantage, particularly when trouble from weed growth is anticipated.

Rates of Superphosphate.

Superphosphate was applied by all but one competitor, the average rate of application being 89 lbs. per acre, an increase of 4 lbs. upon the previous year's average.

The majority of the competitors used rates ranging between 80 lbs. and 100 lbs. per acre.

The rate of application of superphosphate has been gradually increasing in most districts. This has been partly due, no doubt, to the fact that the leading competitors have taken advantage of the results of the experiments at the various Experiment Farms and have obtained profitable results by applying the heavier dressings.

Yields.

Since 1925 the Royal Agricultural Society has awarded a special prize of £5 5s. to the competitor who obtains the highest calculated bushel yield per acre from the competing area of 50 acres. The award this year has been made to Mr. F. S. Freebairn, of Jilakin, near Kulin, whose competing area of the variety Gluclub was calculated to yield 47 bushels per acre. Ths yield, as previously mentioned, also establishes a record yield for this competition, the previous holder being Mr. C. E. Cockram, of Pallinup, with a yield of 46 bushels per acre from the variety Yandilla King.

The winners of the prize to date are as follow:—

1925—Hebiton & Sons, Three Springs, Nabawa, 34 bushels per acre.

1926—Cuming Bros., Carnamah, Yandilla King, 38 bushels per acre.

1927—A. W. Parkinson, Gnowangerup, Yandilla King, 40 bushels per acre.

1928—A. W. Parkinson, Gnowangerup, Yandilla King, 40 bushels per acre.

1929—C. E. Cockram, Pallinup, Yandilla King, 46 bushels per acre.

1930—C. Smith & Sons, Yarding, Gluclub, 43 bushels per acre.

1931—H. O. Beeck, Gnowangerup, Yandilla King, 42 bushels per acre.

1932—F. S. Freebairn, Jilakin, Gluclub, 47 bushels per acre.

This year 125, or 80 per cent. of the crops were calculated to yield 25 bushels or over per acre, 72 or 43 per cent. to yield 30 bushels and over, and 35 or 21 per cent. to yield 35 bushels and over. The corresponding percentages last year were 65 per cent., 36 per cent., and 15 per cent. respectively.

Those competitors obtaining 35 bushels or over per acre are as tabulated below:—

Zone.	Competitor.	District.	Society.	Variety.	Yield.
					bush.
7	Freebairn, F. S. ...	Jilakin	Kulin	Gluclub	47
8	Cockram, C. E. ...	Gnowangerup ...	Gnowangerup ...	Free Gallipoli ...	45
2	Butcher, O.	Dalwallinu	Dalwallinu	Gluclub	42
8	McDonald, J.	Gnowangerup ...	Gnowangerup ...	Bencubbin	42
8	Richards, A.	South Caroling ...	Royal	Gluclub	41
7	Trotter, A. W.	Kulin	Kulin	Bena	41
1	Forrester, J. K. ...	Carnamah ...	Carnamah	Gluyas Early ...	40
5	Kay, J.	Baandee	Merredin	Gluclub	40
8	Stewart, W. B ...	Gnowangerup ...	Gnowangerup ...	Yandilla King ...	40
2	Moore, T.	Indarra	Royal	Bencubbin	39
7	Purser, R. & Co. ..	Jilakin	Kulin	Gluclub	39
7	Scadding, N. A. ...	Jilakin	Kulin	Gluclub	39
7	Stephens, F.	South Lake Grace	Lake Grace ...	Waratah	38
8	Wellard & Wellard ...	Gnowangerup ...	Gnowangerup ...	Yandilla King ...	38
7	Bailey, G. A.	Kulin Rock ...	Kulin	Bena	37
8	Beeck, H. O.	Gnowangerup ...	Gnowangerup ...	Yandilla King ...	37
8	Fleay, C.	Wickepin	Wickepin	Graham	37
1	Hebiton, J. K. ...	Three Springs ...	Three Springs ...	Bena	37
7	Henderson, Mrs. F. F....	Gnarming	Kulin	Queen Fan ...	37
3	Mt. Rupert Co. ...	Wongan Hills ..	Royal	Merredin	37
5	Smith, C. & Sons ...	Bungulluping ...	Bruce Rock ...	Gluclub	37
7	Bishop, H. J.	Lake Grace ...	Lake Grace ...	Waratah	36
7	English, C.	South Kukerin ...	Kukerin	Yandilla King ...	36
3	Jones, W W.	Cowcowing ...	Royal	Bencubbin	36
2	Lock, F. C.	Dalwallinu	Dalwallinu	Bencubbin	36
7	Smith, W. G.	Kondinin	Karlgarin	Ford	36
5	Teasdale, F.	Korbel	Merredin	Bencubbin	36
7	Trestrail, S. J.	Karlgarin	Karlgarin	Gluclub	36
5	Barnet, L. T. C. ...	Walgoolan	Merredin	Gluyas Early ...	35
8	Davis, N. P.	Gnowangerup ...	Gnowangerup ...	Yandilla King ...	35
8	Elliott Bros.	Cliffordville ...	Wickepin	Free Gallipoli ...	35
7	James, S. W.	North Karlgarin ...	Karlgarin	Gluyas Early ...	35
9	Love, W. J.	Ravensthorpe ...	Phillips River ...	Ford	35
2	Sutherland Bros. ...	Dalwallinu	Dalwallinu	Gluyas Early ...	35
7	Treasure, C. W. ...	Karlgarin	Karlgarin	Bencubbin	35

The average calculated yield for all crops inspected was 29.3 bushels per acre, an average which has been exceeded on only one occasion, viz., in 1924, when 31 bushels per acre was obtained from 70 competitors.

The following table shows the comparison between the yields for the 1932 season and the previous five years:—

Zone.	No. of Competitors. 1932.	Average Calculated Yields.					
		1932.	1931.	1930.	1929:	1928.	1927.
1	13	32·1	33·5	28·2	24·7	29·0	28·0
2	8	33·4	26·0	27·6	22·5	19·3	22·4
3	4	34·5	32·5	27·5	23·4	21·3	25·6
4	20	22·8	25·2	26·1	18·2	18 3	29·2
5	15	31·3	28·0	32·7	21·9	20·4	26·2
7	60	29·8	21·8	28·6	22·0	23·0	25·6
8	20	32·8	31·9	30·0	32·2	31·0	32·0
9	28	24·3	23·3	19·8	14·5	..	...
	168	29·3	27·4	27·4	20·7*	22·5	26·9

* The results for 1929 included a number of local competitions planted on fallowed land. There were 156 competitors in the Royal and District competitions that year, the average being 21·7 bushels per acre.

It is to be hoped that the efforts of those who carefully prepared their land, and who harvested good returns therefrom, will stimulate others to do likewise. It must be remembered, however, that the test of efficient farming comes when our season is least favourable. It is then that sound methods prove their value.

FALLOWING.

The conditions of the competition required the crops to be sown on fallowed land. In the preparation of the fallows most of the competitors ploughed their land during the winter months of June to August. It has been definitely demonstrated that higher yields are obtained if the land is ploughed early in the fallowing season than when ploughed later. In this connection in an experiment conducted at the Merredin Experiment Farm for six years (1924-1929), the average yield of plots ploughed the first week in June was 3 bushels 51 lbs. more than those ploughed the last week in August.

The average depth of the initial ploughing was from three to four inches, mouldboard and disc ploughs being used for this operation, while in a few cases rigidtyne scarifiers and springtyne cultivators were utilised for the initial cultural operation. The advantages of using a particular type of implement are determined by the type and condition of the soil to be dealt with. Whether the disc or mouldboard is selected, it is essential that the work be done thoroughly.

For the subsequent working of the fallow in preparation of a seedbed, the springtyne cultivator was the implement chiefly used. A disc implement was favoured, however, when the ground was hard or weedy. The rigidtyne cultivator is also designed and is suitable for this purpose.

Sheep are becoming more numerous throughout the Wheat Belt each year, and their value in assisting to control weed growth on fallow is more widely appreciated.

Experiments at the various experiment farms have shown that increased yields were obtained when heavier dressings of superphosphate up to 150 lbs. were used, particularly on the lighter classes of soil.

The drastic change in the economic conditions of wheat farming, however, alters the interpretation of the results of these experiments because, where in the past more liberal dressings of superphosphate were profitable, this is not so to-day.

An analysis of the results of the rate of superphosphate with wheat experiments shows that when superphosphate is valued at £5 a ton and wheat at 2s. a bushel, the limit of profitable application for the heavy forest country appears to be reached with an application of 112 lbs. per acre, and on the light land, 120 lbs. per acre.

DISEASES.

Diseases found in the competition crops were Ball, Flag and Loose Smuts, Take-all and similar diseases (Foot Rot and Root Rot) and Septoria and Rust. Frost and wind injury were also observed.

Ball Smut.—Although not greatly in evidence, it is surprising to find this disease in competition crops. Though the number of infected crops is yearly diminishing, the economic loss to farmers from this and other preventable diseases is all too large. This disease can be prevented by the use of such fungicides as dry copper carbonate powder or the bluestone or formalin solutions. All are reliable fungicides, but of these by far the most popular is the dry copper carbonate dust. When correctly applied, at the rate of 1½ to 2 ounces per bushel, this method is very effective in preventing the disease. An added advantage with this method is that the seed wheat can be treated and stored immediately after harvest without any detrimental effect, and in addition the copper carbonate acts as a preventive against vermin. The presence of Ball Smut in a crop nowadays is not only indicative of faulty treatment, but also of "slipshod" methods. The results with this treatment have been so highly satisfactory that, where care is exercised and the seed thoroughly dusted, the disease can be entirely eliminated.

Flag Smut.—This disease is becoming more in evidence each year. This is probably due to the fact that a considerable number of farmers fail to recognise the disease when present in their crops. Consequently serious damage is caused before control steps are taken.

A wheat plant affected by Flag Smut has the leaves and leaf sheaths curled, twisted and distorted. Together with the stems, they develop long black streaks running parallel with the veins. The streaks are due to ruptures or slits caused by the fungus, and from these comes the black powder or smut from which the disease derives its name. The affected parts may become quite blackened, and the smut may even penetrate the hollow centres of the straw. Affected plants are either killed or stunted, and at close view show out quite distinctly among the taller healthy plants. Whole stools may be smutted or only some of the shoots, the remainder forming normal, but often undersized ears with little or no grain.

Unlike Ball Smut, where the chief source of infection is from spores on the seed, this disease is a soil infection. Spores from various agencies find their way into the soil, and remain there to attack the wheat crops. It can be seen, therefore, that its control lies not so much from seed treatment, but more along the lines of crop rotation. As a precaution all seed should be treated with dry copper carbonate, and while there is evidence that this diminishes re-infection to a limited extent, it will not control it. The most effective means of control of this disease are by cultural methods in conjunction with the growing of resistant wheats, and it is indeed fortunate that such a popular variety as Nabawa is Flag Smut resistant, as are also the late maturing varieties Yandilla King and Sutton. Other resistant wheats are Bencubbin, Carrabin, Geeralying, and Totadgin, all of which are recommended for planting on infected areas. Gluyas Early, Merredin and Canberra, all early varieties, are very susceptible to this disease.

A certain means of spreading infection throughout the farm is by feeding infected wheaten hay to stock. Oaten hay should be used, as in addition the growing of oats also assists in the control of the disease Take-all. Badly infested wheat stubbles may be burnt and so prevent stock spreading the spores over the farm, either through the agencies of the manure or by carrying it on their bodies. Early fallow and judicious cultivation to keep down weeds and self-sown wheat plants are essential. Where it is known that a paddock is infected, it is advisable to delay seeding until after the first seeding rains.

Briefly the methods of control are as follow:—

1. Fallow early and well.
2. Keep fallows free of weeds and self-sown wheat.
3. Plant resistant varieties.
4. Plant as late as is safe to plant in the sowing season.
5. Discontinue feeding infected hay to stock.
6. Include oats in the crop rotation.
7. Burn the stubble of badly infected crops.

Loose Smut.—Loose Smut or Flying Smut is more difficult to control, as there is no practical method of seed treatment. Seed from badly infected crops should be discarded, and fresh seed obtained from clean crops.

Take-all was very much in evidence this year. This disease is also the result of soil infection, and its control is very similar to that for Flag Smut. There is, however, no variety, as yet, known to be resistant to this disease, and its control

depends, therefore, on the farming practice adopted. In this respect the value of a crop of oats (free of barley or wheat) is of utmost importance.

It was not surprising to find that in some cases where competing crops were badly infested with Take-all, the reason was because no control methods had been taken. *Farmers are advised not to wait until their cropping areas become badly infected before taking steps to control these diseases, but to adopt preventive methods, which include the growing of oats in their cropping rotation.*

Rust.—This is a disease, the prevalence of which depends mainly on the seasonal conditions, over which there is no control. In districts where Rust is likely to occur, farmers should avoid growing rust-liable wheats.

Septoria.—The disease Septoria is most liable to occur when the wheat crop is planted too early. Under these conditions there is a tendency for the plants to make flaggy and rank growth, and as a result they become more susceptible to infection by the fungus. The control consists of seasonable planting and the practice of clean farming methods.

It is not possible in the space of this article to discuss the various diseases fully, but should any reader desire further information concerning these diseases, bulletins are available for free distribution, and can be obtained on application. The bulletins mentioned are—

Septoria, No. 121.
Rust of Cereals, No. 126.
Flag Smut, No. 134.
Cereal Smuts, No. 160.
Foot Rot and Root Rot of Wheat, No· 228.
Partial or complete emptiness in wheat heads, No. 301.
Earcockle and Bacterial Diseases of Wheat, No. 196.

The 50-acre crop competitions have proved invaluable for demonstrating the correctness of methods under varying conditions of soil and climate. When sound methods of farming are adopted, higher yields are made possible, and, under correct business management, the cost of production lowered.

DISTRICT CROP COMPETITIONS, 1932.

I. THOMAS, Superintendent of Wheat Farms.

In addition to the 50-acre crop competitions conducted by the Royal and District Agricultural Societies, competitions were also conducted by unaffiliated bodies or by agricultural societies who conducted competitions additional to those in connection with the parent body.

The District Agricultural Society of Phillips River conducted a 25-acre crop competition. and that of Bruce Rock conducted a 50-acre crop and fallow competition. A 50-acre crop competition was organised by the Wialki-Bonnie Rock Settlers' Association, although this differed from the two previously mentioned in that it was not a condition that the crop should necessarily be planted on fallowed land.

In all, there were 19 entries, the average yield for all competitors being 23.5 bushels per acre. The average yields for the competitors on fallowed and unfallowed land were as follows:—

Fallowed	25.1 bushels.
Unfallowed	16.8 bushels.

The judges' reports and awards, together with a detailed summary of the rainfall and cultural details are as follow:—

BRUCE ROCK AGRICULTURAL SOCIETY.

Judge—R. P. Roberts, Agricultural Adviser.

The above society commenced a fallow and crop competition in 1931 for which there were seven entries, the report on which appeared on page 108 of the March, 1932, issue of the *Agricultural Journal.*

In continuation of this competition, crops were to be planted last year on the fallow so entered, but only three of the original seven participated. The combined awards made by the judge for both sections were as follow:—

Awards.

Competitor.	Address.	Variety	Yield. 50 points.	Freedom from weeds. 10 points.	Freedom from disease. 10 points.	Freedom from admixture. 15 points.	Evenness of growth. 15 points.	Total. 100 points.	Fallow competition Awards. 100 points.	Total. 200 points.
Farrell, F. C. & Sons	Yarding ...	Bencubbin ...	32	8	7	12	12	71	90	161
Smith, C. & A. H.	Yalbarrin ...	Gluclub ...	30	7	7	13	11	68	91	159
Smith, C. & Sons	Yarding ...	Gluclub ...	31	7	7	13	12	70	86	156

The rainfall as recorded at Bruce Rock was as follows:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Bruce Rock ...	70	8	29	57	230	99	288	355	62	340	1,374	...	8	1,546

The cultural details were as follows:—

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Original timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Graded.	Diseases.
						in.				lb.	lb.		
Farrall, F. C. & Sons	Old land	Salmon gum, gimlet and a little mallee	Early June	Good	Mouldboard and disc	4	Half rigidtyne cultivated and balance disc cultivated in mid-August. Springtyne cultivated in Oct. and Jan. Springtyne cultivated last week in April	Bencubbin	7th–8th May	54	96	Yes	Take-all
Smith, C. and A. H.	Old land	Salmon gum, and gimlet	Early June	Good	Mouldboard	3	Springtyne cultivated in August–Sept Rigidtyne scarified in October	Gluclub	1st week May	45	125	Yes	Take-all and a little flag smut
Smith, C. & Sons	Old land	Salmon gum and gimlet	July	Good	Disc	3	Disc cultivated Aug. and Sept.	Gluclub	2nd week May	48	90	Yes	Take-all and a l ttle flag smut

WIALKI-BONNIE ROCK SETTLERS' ASSOCIATION.

Judge—N. DAVENPORT, Agricultural Adviser.

As the result of a generous donation by Mr. A. W. Bevan, Agricultural Bank Inspector for the district, a 50-acre crop competition was conducted with the object of improving the farming practice of this new area.

It was realised that if entries were limited to those planted on fallow, there would be too few participating, so for the first year only, crops planted both on fallowed and unfallowed land were allowed to compete. There were eight entries, the awards for which are set out below—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Chamberlain & Pratt	Beacon ...	Nabawa ...	21	9	9	14	12	65
O'Neil, T. M. J. ...	Wialki ...	Noongaar ...	18	9	9	14	13	63
Baber, A.	Bonnie Rock	Nabawa ...	19	9	9	14	11	62
Broomhall, V. ...	Wialki ...	Gluyas Early	18	9	8	13	12	60
Caunt, F.	Bonnie Rock	Noongaar ...	18	8	9	13	12	60
Milligan Bros. ...	Wialki ...	Noongaar ...	17	9	9	12	13	60
Jackman, R. C. ...	Bonnie Rock	Noongaar ...	15	8	9	14	12	58
Barwise, P. ...	Wialki ...	Noongaar ...	14	7	8	13	13	55

The rainfalls recorded for Wialki and Bonnie Rock were as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Wialki	46	56	107	63	129	113	179	298	36	168	923	...	50	1,245
North Wialki ...	34	75	95	77	181	109	198	380	36	215	1,119	...	...	1,400
Bonny Rock ...	77	97	90	102	124	117	188	337	44	168	978	...	60	1,404

The cultural details of the respective entries were as follow:—

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
Chamberlain & Pratt	New land	Mallee and teatree	Aug.	Good	Disc ...	in. 2	Planted with combined cultivator drill	Nabawa	3rd week April	lb. 45	lb. 90	Copper carbonate	Yes	
O'Neil, T. M. J.	2	Salmon gum, gimlet, mallee, white gum	...	...	...	...	Springtyne cultivated 2nd week May; planted with disc drill	Noongaar	1st week June	36	90	Copper carbonate	No	
Baber, A. ...	New land	Salmon gum, mallee, gimlet and scrub	June	Good	Disc ...	4	Springtyne cultivated prior to seeding with disc drill	Nabawa	2nd week May	45	76	Copper carbonate	Yes	
Broomhall, V.	New land	Salmon gum, gimlet, snap and rattle	Aug.	Fair	Disc ...	3	Springtyne cultivated in March; planted with combined cultivator drill	Gluyas Early	1st week May	32	60	Copper carbonate	Yes	
Caunt, F. ...	New land	Salmon gum, gimlet, snap and rattle	...	...	...		Springtyne cultivated March; planted with combined cultivator drill	Noongaar	3rd week June	38	75	Copper carbonate	No	
Milligan Bros.	New land	Salmon gum, and gimlet	...	...	...	..	Springtyne cultivated April; planted with combined cultivator drill	Noongaar	last week May	36	70	Copper carbonate	Yes	Ball Smut
Jackman, R. C.	New land	Salmon gum	June	Good	Disc cultivating plough	3–4	Planted with combined cultivator drill	Noongaar	2nd week June	37	45	Copper carbonate	No	
Barwise, P. ...	2	Salmon gum and gimlet	...	...	...		Springtyne cultivated early March. Planted with combined cultivator drill	Noongaar	last week May	45	60	Copper carbonate	Yes	Flag Smut

PHILLIPS RIVER AGRICULTURAL SOCIETY.

Judge—L. G. Seinor, Manager, Salmon Gums Experiment Farm.

In addition to the 50-acre crop competition conducted by the above society as a participant in the Royal Agricultural Society's Competition, a separate local 25-acre crop competition was also conducted. There were eight entries for the latter, the awards made being as follow:—

Awards.

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
McCulloch, J. ...	Ravensthorpe	Merredin ...	37	9	9	14	14	83
Love, W. J. ...	Ravensthorpe	Ford ...	35	9	9	14	14	81
Campbell, J. ...	Ravensthorpe	Gluyas Early	29	8	9	13	13	72
Barrett Bros. ...	Ravensthorpe	Noongaar ...	23	8	8	13	13	65
Metz, E.	Ravensthorpe	Ford ...	22	8	8	13	12	63
Mitchell, C. J. ...	Ravensthorpe	Merredin ...	22	8	9	12	12	63
Bebbington Bros. ...	Ravensthorpe	Gluyas Early	22	8	8	12	12	62
Chamber Bros. ...	Ravensthorpe	Merredin ...	21	7	8	13	12	61

The rainfall recorded at Ravensthorpe is shown below:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Ravensthorpe ...	147	77	113	193	206	198	145	235	167	430	1,381	62	7	1,980

The cultural details of the respective competitiors are as follow:—

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Timber.	When ploughed	Condition of land.	Implement.	Depth.	Subsequent Cultivations.	Variety.	When Planted.	Rate of seed.	Rate of super.	Seed treatment.	Graded.	Diseases.
						in.				lb.	lb.			
McCullock, J.	...	Salmon gum and yate	July	Good	Disc	3–4	Cross-ploughed Sept. and cultivated ahead of drill	Merredin	Late May-Early June	45	85	Dry	No	
Love, W. J. ...	3rd year	Heavy salmon gum	June-July	Good	Mouldboard	3–4	Springtyne cultivated August and ahead of drill	Ford ...	1st week May	38	65	Dry	Yes	No
Campbell, J....	2nd year	Jam, salmon gum and wattle	June	Good	Mouldboard	3–4	Springtyne cultivated March and again ahead of drill	Gluyas Early	Last week May	45	90	Dry	Yes	Flag Smut
Barrett Bros.	...	Salmon gum and mallee	June	Good	Disc	3–4	Springtyne cultivated August and Sept. and ahead of drill	Noongaar	1st week June	50	112	Dry	Yes	
Metz, E. ...	3rd year	Salmon gum, yate and mallee	July	Good	Disc	3–4	Cross-ploughed September	Ford ...	Middle-May	45	48	Dry	No	
Mitchell, C. J.	...	Mallee ...	July	Good	Mouldboard	3–4	Springtyne cultivated Sept., tandem disc cultivated October and February, and ahead of drill	Merredin	2nd week June	45	40	Dry	Yes	
Bebbington Bros.	...	...	June-July	Good	Mouldboard	3–4	...	Gluyas Early	May	45	100	Dry	Yes	
Chamber Bros.	3rd crop	Mallee and gimlet	July	Good	Mouldboard	3–4	Springtyne cultivated August and again ahead of drill	Merredin	Early May	45	65	Dry	Yes	

LIVE STOCK AND MEAT.

For the information of readers of this "Journal," the following particulars have been supplied by Messrs. Elder, Smith and Coy., Ltd., Perth:—

COMPARATIVE NUMBERS OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS FOR MONTHS OF DECEMBER, 1932, JANUARY AND FEBRUARY, 1933.

—	December.			January.				February.			
	7.	14.	21.	4.	11.	18.	25.	1.	8.	15.	22.
Sheep	10,943	11,346	15,102	15,253	12,497	13,339	11,793	10,526	10,858	8,267	11,747
Cattle	451	483	728	651	610	612	374	436	501	440	544
Pigs	1,368	1,993	1,579	970	1,507	1,880	2,148	1,538	1,598	1,538	972

COMPARATIVE VALUES PER POUND.

Mutton	2½d.	2¾d.	3d.	3d.	3d.	2¾d.	2¾d.	2¾d.	2½d.	3d.	4d.
Beef	5d.	5½d.	5½d.	5d.	5d.	4½d.	4¾d.	4¾d.	5d.	5½d.	6d.
Pork	5¾d.	5¾d.	6d.	6½d.	5¾d.	5¾d.	5½d.	5d.	4d	4d.	4½d.
Bacon	4¾d.	4¾d.	4¾d.	4½d.	4½d.	4½d.	4d.	4d.	3½d.	3½d.	3½d.

MARKET REPORT.

Messrs. H. J. Wigmore & Co., Ltd., of Wellington Street, Perth, have supplied us with the following information regarding the Chaff available for auction at the Perth Railway Yards, for the period December to February inclusive.

December.—1,010 tons of Chaff: F.a.q. to prime Wheaten Chaff was making from £3 17s. 6d. to £4; f.a.q. from £3 12s. 6d. to £3 15s. per ton. Medium quality sold at from £3 5s. to £3 7s. 6d. Prime Oaten Chaff was finding buyers at auction, and also selling to arrive at £3 15s. to £3 17s. 6d.; f.a.q. at around £3 12s. 6d. per ton.

Oats: Heavy supplies were arriving to a dull demand, and good heavy feeds were realising from 1s. 7d. to 1s. 7½d.; good feeds 1s. 5d. per bushel.

Wheat: In the early part of December f.a.q. was finding buyers from 3s. to 3s. 1d.; second grade from 2s. 6d. to 2s. 8d. per bushel.

January.—790 tons of Chaff: F.a.q. to prime Wheaten Chaff was selling at £4 2s. 6d. to £4 5s., several consignments of prime quality being knocked down at £4 10s. per ton. F.a.q. found buyers at £3 15s. There was very little alteration in the price of Oaten Chaff during the month, best samples making £3 17s. 6d. per ton; f.a.q. from £3 12s. 6d. to £3 15s. per ton.

Oats: Owing to short supplies coming forward the market for good heavy feed Oats firmed, this quality selling at from 1s. 10d. to 1s. 10½d.; good feeds at 1s. 6d. per bushel.

Wheat: At the beginning of the month f.a.q. was making 3s.; but towards the end of the month the market eased to 2s. 8d. per bushel. Second grade found buyers at from 2s. 4½d. to 2s. 5d.

February.—685 tons of Chaff. F.a.q. to prime Wheaten Chaff realised £4 10s., several trucks being knocked down at £4 12s. 6d. per ton. F.a.q. was making from £3 17s. 6d. to £4. Best samples of Oaten Chaff were selling at £4 per ton; f.a.q. from £3 12s. 6d. to £3 15s. per ton.

Oats: Good heavy feeds were finding buyers at from 1s. 10d. to 1s. 11d.; good feeds from 1s. 6d. to 1s. 9d. per bushel.

Wheat: F.a.q. made from 2s. 7d. to 2s. 8d., but towards the end of the month several consignments sold at from 2s. 10d. to 2s. 11d. per bushel. Second grade was realising from 2s. 4d. to 2s. 5d.

H. J. Wigmore & Co., Ltd., hold auction sales in the Perth Railway Yards, each morning, for Chaff, Grain and Potatoes, and all consignments forwarded to their care receive their best and prompt attention. The highest market prices with prompt returns are guaranteed.

Live Stock.

PRODUCERS' MARKETS CO-OPERATIVE LIMITED.

REPORT OF SALES FOR THE QUARTER ENDED 28th FEBRUARY, 1933.

Fruit.—Although stone fruit has been prolific, conditions have not been so difficult as might have been expected with the recurrence of the triennial stone fruit glut in a period of depression. This particularly as weather conditions throughout the summer (with the exception of only one week) have been unusually mild, consequently limiting demand. There has been evidence of greater care by growers generally in regard to thinning and packing, and this has doubtless helped to maintain prices at better levels than would otherwise have been possible.

The opening of the stone fruit season was rather later than usual and supplies came in very steadily until Christmas week. A very sudden increase then occurred, and, as weather conditions were very unfavourable from a point of public demand, market conditions proved most difficult and values fell away. After the holidays supplies were steadier, and, considering the seasonal conditions above mentioned, reasonable rates were obtained for most quality lines.

Plums were heavily supplied. Very heavy quantities of small lines resulted in some low prices at one period.

With the exception of the holiday period prices for high-grade lines have been remarkably good in the circumstances. Many growers suffered heavy losses with the Rutherglen bug during January and a large proportion of supplies suffered in value due to the appearance being spoilt by this trouble.

Oranges and lemons were freely supplied during December and in the absence of hot weather conditions, and with other lines heavily supplied, no marked increase in values was evident until the New Year. During January supplies of oranges eased and from then on the market has been firm and many lines which were not over-attractive realised good prices. Lemons improved, and, during the exceptionally hot week experienced in February, some very substantial prices were realised. Many lines suffered in quality during the heat wave, and although demand has since eased, limited supplies have realised very good values.

It appears that the acreage planted to the early local tomatoes was much heavier than usual, and supplies on some sale days were double those of December, 1931. The demand for this line is influenced by weather conditions to a greater extent than any other, and prices were therefore on a very much lower scale than in the preceding season. The only lift in the market until after the end of the period under review was during the February heat wave, when values jumped whilst the hot weather lasted, but fell back thereafter under the pressure of decreasing public demand and increased supplies.

Apples ex cool store were available through December, although in smaller quantities than the preceding month. The tone was firm until Christmas week when the conditions mentioned in regard to other lines brought prices back rather suddenly. Very short supplies after Christmas realised good prices for a week or so. New season lines were short supplied at the beginning of January and values were very firm, easing to quite fair prices as supplies increased. Coloured apples were scarce right through to the end of February and early Jonathans have made some quite good values.

The crop of Bartlett pears has apparently been exceptionally heavy in nearly all districts, and orchard supplies have been available freely later than is usual. In the circumstances it was not possible to secure high rates, and the usual distinction between prices obtainable for pears from fruit-fly infested areas in comparison with that from free areas was particularly noticeable during February.

Vegetables.—An unusually favourable growing season during the spring and early summer induced the heaviest supplies which have been known for some years in nearly all lines. This, coupled with limited buying power, resulted in a disastrous price level throughout December and into January. The difficulty was accentuated by a very heavy metropolitan crop of potatoes for which no export outlet could be found and only nominal prices were obtainable. Quite apart from the over supply of other lines the price of potatoes had the effect of limiting the price obtainable for alternative vegetables.

The experience of Christmas week mentioned in regard to fruit was emphasised in the case of vegetables; the quantities to be offered were altogether out of relation to the public demand.

Pumpkin was at fair value early in December but soon fell away to a low price. Swedes were also in fair demand during the quarter and the prime lines realised high values at times. Cabbage during December was glutted, many lines being left unsold; during January and February, however, values improved considerably for prime lines. Beans also were heavily supplied until towards the close of February. Peas were in steady demand all through, although contrary to the usual experience they were at glut level during the Christmas season. Onions, the bulk of which were marketed from the Spearwood district during this season, were also a heavy crop, and values, although fairly good during the first part of December, fell sharply and have remained on the low side since. Although exceptional lines of both white and brown caused brisk competition, the very low price at which Victorian onions can be purchased for importation has placed a limit on the price obtainable for local onions.

Rhubarb is not in demand during the summer months as there are plenty of cheap fruits to take its place, and nominal values have been the rule.

Celery is a line that is grown plentifully; all good and well cared for lines demand high values. Water melons started soon after the New Year and values generally were good. This line depends solely on weather conditions, and growers who were fortunate enough to market their crop during the hot spell were amply rewarded. When autumn temperatures came in towards the end of February the public demand for water mēlons fell away heavily, although quantities increased, and values were effected correspondingly. Rock melons were heavily supplied and inferior sorts were hard to quit at satisfactory values.

Bunch lines also were heavily supplied and seldom rose above glut level until supplies eased. This also applies to lettuce.

The heat wave had the effect of destroying many lines, and phenomenally heavy supplies were replaced generally at the close of February with comparatively short offerings. Prices reached quite high levels for many lines.

Eggs.—During the first week in December many growers discontinued export operations, owing to some of the export agents reducing the rate of the advance, and this had the effect of increasing the supplies on the local market. The supplies were now becoming geater than the demand and values were declining on those ruling when export operations were at their top. On December 17th all agents

ceased packing for export, and all surplus eggs, formerly accepted for export, were placed on the local floor and it was only the Christmas demand that kept values from declining below 7d. a dozen for metropolitan new laid standard, and 6d. per dozen on metropolitan new laid hen.

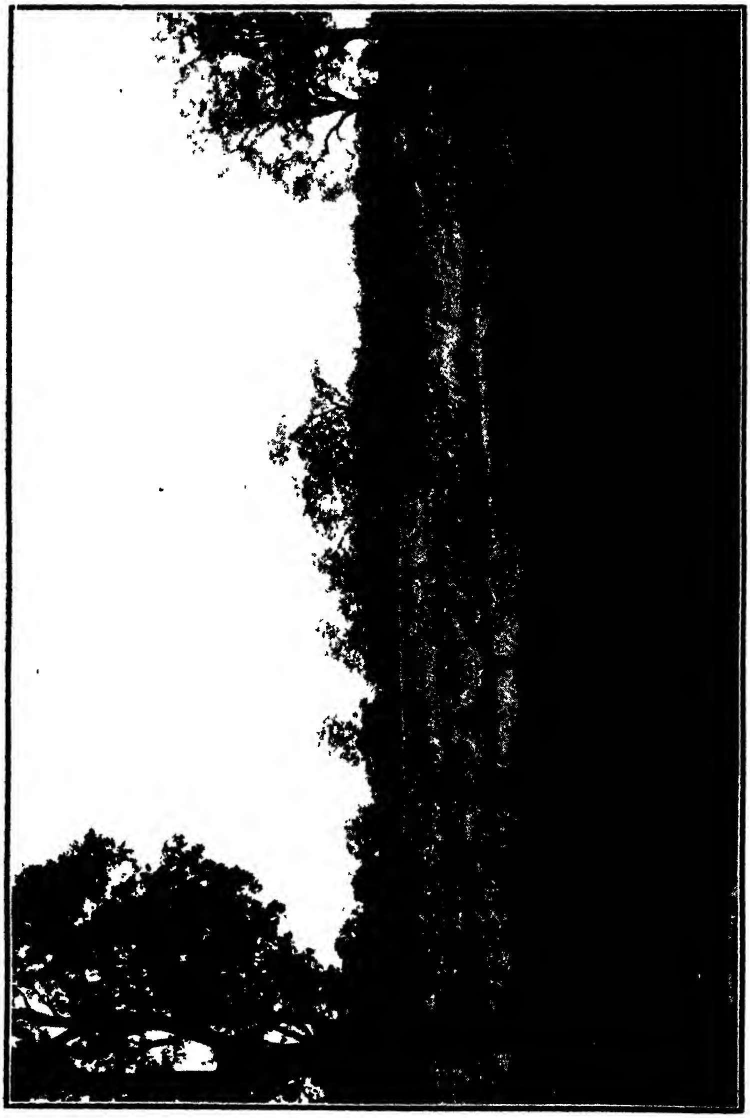
After Christmas local supplies were maintained and unusually heavy supplies received from country centres. Public demand was at a minimum, and although steps were taken to cool store during this period sales were difficult and many lines were hard to quit; but for the manufacture of a substantial experimental quantity of pulp for export during this period the position might conceivably have been even more difficult.

During January values ranged as under:—

Metropolitan new laid standard	7d.	to	10½d.
„ „ „ hen	6½d.	to	10d.
„ „ „ pullet	5d.	to	8½d.
Country new laid	5d.	to	8½d.
„ stores	4d.	to	6½d.

During the early weeks of February eggs were heavily supplied and sold to a good demand at slightly firmer values. Owing to the excessive heat prevailing, supplies arrived in a heated condition and there were numerous complaints regarding the quality. The heat also caused the fowls to moult, and the supply of standard and hen eggs was not equal to the demand. Values increased until they rose 5d. a dozen in one day to 1s. 10½d. a dozen for standard eggs. This sudden rise in price checked consumption and as the fowls re-commenced to produce almost as many eggs as before the heat wave, values fell away to the extent that they receded to 9d. a dozen for standard eggs.

Poultry.—During December supplies of all lines sold to a good demand for prime quality. Prime gobblers and turkey hens were keenly sought after and sold at good values. Prime cockerels sold at values up to 9s. pair, prime table hens to 7s. pair, Muscovy drakes to 14s. 6d. pair, Muscovy ducks to 7s. 6d. pair, turkey gobblers to £2 pair, and turkey hens to 16s. 6d. pair. After the Christmas rush supplies eased and values remained firm for prime quality. During January and February there were no turkey hens nor gobblers offering. Muscovy ducks and drakes short supplied and sold to a fair demand only. Although hens and cockerels were heavily supplied there was a keen demand for prime quality. Prime cockerels realised to 9s. a pair, and prime black or red hens to 7s. pair. White leghorns also sold to a keen demand at improved values.



Harvesting virgin land.

METEOROLOGICAL INFORMATION.

Stations.	December, 1932. Temperature. Maximum. Mean.	Highest.	Minimum. Mean.	Lowest.	Rainfall. For Month	Average.	January, 1933. Temperature. Maximum. Mean.	Highest.	Minimum. Mean.	Lowest.	Rainfall. For Month.	Average.	February, 1933. Temperature. Maximum. Mean.	Highest.	Minimum. Mean.	Lowest.	Rainfall. For Month	Average.
					inches.	inches.					inches	inches.					inches.	inches.
Chapman State Farm	89·7	105·3	60·7	50·3	·33	·24	93·2	110·0	64·3	55 8	·11	·29	97·1	114·4	66·6	56·4	Nil	·44
Geraldton	81·8	102·0	62·3	48·0	·06	·16	84·9	110·0	65·8	58·8	·08	·22	87·6	115·5	68 4	61·2	·01	·29
Waleiing	90·6	109·5	57·3	48·1	·08	·48	92·5	106·3	62·1	53·8	·20	·34	98·7	115·2	64·7	50·1	Nil	·50
Perth	80·6	96·4	59·9	49·8	·20	·57	84·4	102 6	64·9	56·8	·57	·34	90·3	112·2	66·8	58·2	·11	·42
Kalamunda	83·0	97·8	56·8	45·0	·20	·78	85·0	104·5	61·4	53·0	·63	·51	92·7	110·0	66·3	52 3	·04	·61
Bunbury	77·5	89·0	54·7	43·0	·11	·57	81·8	95 5	59·7	49·0	·67	·43	86·0	104·2	61·7	48·0	·18	·53
Bridgetown	86·4	100·2	49·4	32·5	·39	·77	87·7	106·0	55·3	43·5	·64	·55	94·0	115·0	54·9	39·5	·18	·63
Albany	22·8	91·0	56·0	47·8	·33	1·18	75·0	92·0	59·4	52·8	1 64	·83	78·5	112·6	60·7	53·2	·25	·92
Merredin State Farm	89·9	104·0	57·6	45·8	·31	·52	90·8	102·3	61·0	52·9	24	·49	96·6	110·3	64·9	53·1	Nil	·54
Northam	89·8	104·8	58·3	47·2	·13	·35	90·9	103·0	61·8	56·2	·21	·27	97·5	114·9	64·3	52·6	·10	·38
York	88·4	101·5	56·5	43·0	·12	·41	90·0	103·5	60·5	54 5	·25	·30	96 1	113·0	62·8	52·0	·19	·43
Narrogin State Farm	85·5	98·0	50·7	36·4	45	·57	87 5	99·8	55·4	49·8	1·34	·33	92·8	109·1	57·6	42·2	Nil	·53
Katanning	84·4	97 0	51·6	37·6	·28	·63	86·4	101 0	55·9	47·7	1 05	·37	91·9	112·3	59·4	48·7	·31	·54
Cape Leeuwin ...	70·4	79·5	59·2	54·5	·27	·83	71·2	97·0	62 4	56·0	·47	64	77·2	109·0	65 2	61·5	·27	·83

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE

LIST OF BULLETINS AVAILABLE FOR DISTRIBUTION.

No. 20.—*The Pruning of Fruit Trees.* J. F. Moody. Price 2s. 6d.
No. 38.—*Linseed or Flax and It's Cultivation.* Geo. L. Sutton.
No. 46.—*Fruit Packing and Marketing and Exporting of Fruit.* J. F. Moody and J. Ramage. Price 1s. 6d.
No. 49.—*The Feeding of Horses.* Professor Paterson and G. L. Sutton.
No. 57.—*Vermin Destruction.* A. Crawford.
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THE PREPARATION OF THE FARMER'S CLIP.

By HUGH MCCALLUM—Sheep and Wool Inspector,
and W. McC. JOHNSON—Cadet.

So many articles have been written by representatives of all sections of the woollen industry amply proving the financial soundness of expending labour on classing, or, if necessary, money for the payment of a professional classer in order that a well-prepared clip may be forwarded for sale, that it is almost unnecessary to devote space to a preliminary discussion of the economical aspects of classing. May we, however, remind our readers that many of these articles, including several prepared by one of the writers, were published during the period following the Great War, when wool-growers were disposing of their product at highly remunerative prices. If it was then considered by those who were interested in the welfare of the industry, that the operation of classing was of such importance to growers that they should persistently urge them to pay more attention to it, surely it is imperative that sheep farmers to-day, when ruling prices leave little, if any, margin of profit, should perform this operation with meticulous care.

This article has been prepared with a view to assisting in the preparation of their clips, those wool-growers who depasture flocks of less than 2,000 sheep, for such a flock will not produce a wool clip sufficiently large to warrant the engagement of a professional classer. It will deal briefly, but clearly we hope, with all the operations involved in the preparation of the clip, with the single exception of shearing. This is usually made the work of an expert, but in order to assist farmers who do not engage such experts, the "Shearing of Sheep" has been made the subject of a separate article which will be forwarded for publication in the next issue of this Journal.

Preparation.

Before shearing is commenced, careful preparation must be made. All machinery should be thoroughly overhauled in order to ensure that it is in perfect running order.

The shearing board should be washed and then continually swept while shearing is in progress. Tables and wool bins and baskets should be carefully cleaned and placed in position or else temporary bins should be erected in order to facilitate the work of classing. Finally, it is advisable, where possible, to keep the yards watered during shearing in order to prevent dust from rising and becoming incorporated in the fleece.

Picking up and Throwing.

When the shearer commences his work, he will first remove the belly wool. This should immediately be picked up and placed in its allotted basket. In the case of a wether, the part of the wool stained by urine should be removed and placed in a basket reserved for stained pieces, as this stain is permanent, that is to say, it cannot be removed by ordinary methods of scouring. When the rest of the fleece is removed, it will lie on the floor, with the newly clipped or flesh end of the staple upwards. The "picker up" should stand with his feet under the neck portion of the fleece, then stoop over and grip firmly the britches, or wool from each hind quarter, and draw it round the rest of the fleece. The fleece will then be carried to the table and spread out by throwing the arms forward over the table, allowing the neck portion to go first and retaining the grip of the britch portions of the fleece until it is entirely spread out. This reverses the fleece, turning the outside or tip of the staple upwards. These operations of picking-up and throwing are very important links, and if they are skilfully performed, will enable the skirting to be carried out in a more satisfactory manner.

In the case of lambs, the wool should be gathered from the floor between two light boards, about 18 inches long by five inches wide.

Skirting.

The fleece is now in position for the very important operation of skirting. As it is so important, it is unfortunate that no definite rules can be set down regarding its performance, for it is governed largely by the vagaries of the season and the quality of the fleece. The object of skirting is, of course, to remove all portions of the fleece which differ from the main part. Such differences may be of quality, length of staple, colour, soundness or condition. The portions of the fleece which exhibit these differences will probably be the wool from the arm pits, which will be short-stapled and sweaty ; the wool from the flanks, which will be discoloured ; the cheek wools, which will be short stapled ; the neck folds, which will be rough and matted ; and the short hairy breeches. Under some seasonal conditions, sheep pastured in the agricultural and pastoral districts of the State will carry in the back wool a great deal of dust and sand. Under such circumstances, this portion of the fleece should be removed with the rest of the skirtings. Again, in some districts in all seasons, and in practically all districts in some seasons, the outer portions of the fleece will contain seed or burr. When this is so, it should be skirted more heavily, that is more deeply, into the body of the fleece. When this work has been skilfully performed the fleece wool, which remains, will be clean and of an even length of staple.

Rolling.

The fleece must now be rolled so that it may be conveniently placed in the bin to which it belongs, where it will await baling. There is now one method commonly adopted of so treating the fleece. One side of the fleece is folded over for a margin of one-third of its width. The folded portion is then turned right over to the further edge of the fleece. This leaves it in three layers with the back wool showing on top. The fleece should now be rolled from tail to neck. By this means the back wool, which is the least attractive portion of the skirted fleece, is rolled in the centre and the shoulder wool, which is the most attractive, is finally left exposed.

Classing.

It is necessary to class wool so that buyers may be given an opportunity of purchasing the lines in which they specialise, for some manufacturers buy fleece wool only, while others concentrate on pieces, bellies, lambs, etc.

This is generally recognised. One can see, however, from an inspection of the clips displayed for sale on the Show floor that many growers have not yet realised

the immense importance of separating wools of different lengths of staple, quality, soundness, colour and condition.

It must, of course, be understood that rules concerning the division of such wools will be applied more or less rigorously according to the size of the clip. For instance, a farmer with a clip of 25 bales could not separate so deliberately wool of different length of staple, quality, etc., as one with a clip of say 200 bales, or he would be hopelessly overclassing his wool, which is almost as undesirable as underclassing. He must learn, therefore, to make his lines as even as possible, whilst keeping them of reasonable size.

Let us, therefore, consider a farmer with less than 2,000 sheep. It will be possible, in classing the clip, to separate the strong wools from the medium and fine. The size of the clip, however, will not permit of the separation of wools of similar quality which do not differ greatly in length of staple. The few fleeces, and they should be few if the flock is carefully culled, which are very short in the staple could be placed in the caste line. This is not, under modern manufacturing conditions, a very serious matter, for improved machinery has modified the requirements of such different sections of the trade as Combers and Carders, who could once only buy wools of specific length.

"Tender" fleeces must be kept out of the sound lines and placed in the caste lines, or if there are many—as there may be under some seasonal conditions—placed in a separate line and branded "Fleece." Finally, the black-tipped and heavy fatty fleeces must be separated from these light to medium-conditioned lines. The importance of this cannot be over-emphasised. One frequently sees say three bales, representative of a line opened up on the Show floor apparently very attractive and even in condition; when a buyer in trying to estimate the yield of the wool discovers deep down in a bale one heavy conditioned fleece. This may be the only one in the line, but it destroys the buyer's confidence in the clip and he will be very conservative in his estimate of its yield. This may mean pence per pound to the vendor.

Classing.

The following are the lines into which such a clip would probably be divided, with a description of the wools to be found therein:—

Fleece Wool—

AA	Sound, good length, light condition 64's and upwards.
A	Sound, shorter, heavier 64's and upwards.
BB	Sound, good length light to medium condition 60's.
B	Sound, shorter, heavier 60's.
C	Short, fatty or tender.

(In some seasons, the number of tender fleeces may necessitate the making of a separate line branded "Flc." or even of two lines:—

A Flc.—the finer tender fleeces.
B Flc.—The broader tender fleeces.

Skirtings—

A Pcs.	The longest, lightest and freest pieces.
Pcs.	Shorter and heavier.
Bls.	Probably one line of bellies minus stains.
Bks.	The earthy backs previously referred to.
Std. Pcs.	One line minus dags.
Lks.	One line minus dags.

It is a very bad policy to allow dags and fribby ends to be included in a bale of locks or stained pieces as the buyers do not pay for these, while the freight must be paid.

Lambs—

A lbs. Longest and light to medium conditioned 64's/60's.
lbs. Shorter and heavier 64's/60's.

Baling and Pressing.

It is impossible to bale wool neatly without the use of a press of some description. There are, on the market, several types of presses which have been designed to meet farmers' requirements and can be purchased very cheaply. However, there have been serviceable presses constructed on a farm from directions and diagrams which have appeared in the press and various publications. If a wool-grower does not possess a press and wishes to avoid the expense of purchasing one, he may obtain full constructional details from this Branch of the Department.

Packages of fleece or skirtings cannot be offered by auction as a bale of wool unless they weigh 201 lbs. gross, or in the case of lambs' wool, 151 lbs. gross. Any package below those weights is considered a light weight and has to be sold separately as such. When baling, it is desirable that the packing should be adjusted so as to eliminate light weights, but a mixed bale must not be made under any circumstances. It is far better to pack oddments in bags.

Branding.

The bale must now be branded. This operation was discussed in detail in the last issue of the Journal, but for the benefit of new readers and the sake of completeness, we shall include a brief summary of the directions given. The bale should be branded, using a stencil and reliable black ink on the sewn or hooked cap and on the front of the wool pack with the name of the holding, the abbreviations describing the contents and the number of the bale. Growers must on no account place any mark on the bottom of the bale, as this is reserved entirely for the buyer's countermark or port of destination.

These operations of pressing, baling and branding are very important, as the buyer obtains his first impressions of the clip from the appearance of the bales, and if they are neatly pressed and correctly branded they will inspire confidence in him.

We are conscious, of course, that this brief outline of the operations involved in the preparation of a clip would be much more valuable if it were illustrated by plates, depicting the various steps, but, unfortunately, these were not available. We would, however, refer our readers to the Departmental Bulletin, No. 60, which—although issued before the new methods of classing and branding were drawn up by representatives of the Selling Brokers and Wool Buyers, contains much valuable and more detailed information and in addition is very clearly illustrated.

It has been said that one effect of the depression prices for wool has been to stimulate interest in effective classing. If this is so, it at least is something for which we can be thankful. At any rate, whatever the cause may be, the "get up" of the Western Australian clip has certainly been greatly improved during the last few years, and it is very gratifying to hear of the praise which Mr. deLatour, the President of the Wool-buyers' Association, in his review of the selling season recently completed, bestowed on the classing of our clip. At the same time it is realised that there is still much room for improvement in the "get up" of many of our smaller clips, and it was, therefore, considered worth while to direct the attention of these growers to this phase of their work so that, when prices recover, they will, with the larger growers, reap the maximum reward.

THE REARING OF DAIRY CALVES.

L. C. SNOOK, B.Sc. (Agric.), Agricultural Adviser, Dairy Branch.

In order to accelerate the rate of improvement in productivity of the average dairy cow, the Department is actively advocating a policy embracing grade and pure bred herd recording, and the use of pure bred bulls ex tested dams. Herd recording enables the farmer to discover the high producing cows, and the use of a bred-for-production bull should ensure that the progeny of these cows are at least as productive as their dams. If full benefit is to be derived from these well nigh essential practices, it is necessary that a draft of healthy heifer calves be raised each year.

It is hoped that the following outline of the fundamental principles involved in the rearing of calves will prove of interest and value.

The article, for convenience, has been divided into three sections:—

1. Feeding, where separated milk is available.
2. The use of milk substitutes.
3. General management.

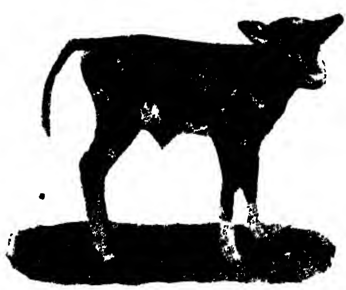
CALVES REARED ON SEPARATED MILK.

Time to separate Calf from Dam.

Most dairy calves are taken away from their mothers within a week of birth and are reared on milk fed per medium of the bucket. Opinions differ regarding just when to separate the calf from its dam. Some breeders take the calf away almost as soon as it is born, reasoning that this prevents growth of affection. The most common practice, however, is to leave the pair together for one or even two days. This has many advantages—the delicate calf receives its natural food at short intervals, and the sucking and massaging of the udder does much to reduce inflammation and to sooth the cow. It certainly seems wise to delay separation for at least 24 hours.

Calf must obtain Colostrum.

The calf always should receive its mother's milk for at least seven days. The first milk or colostrum is specially constituted to act as a purgative and also plays



The delicate age (first four weeks).

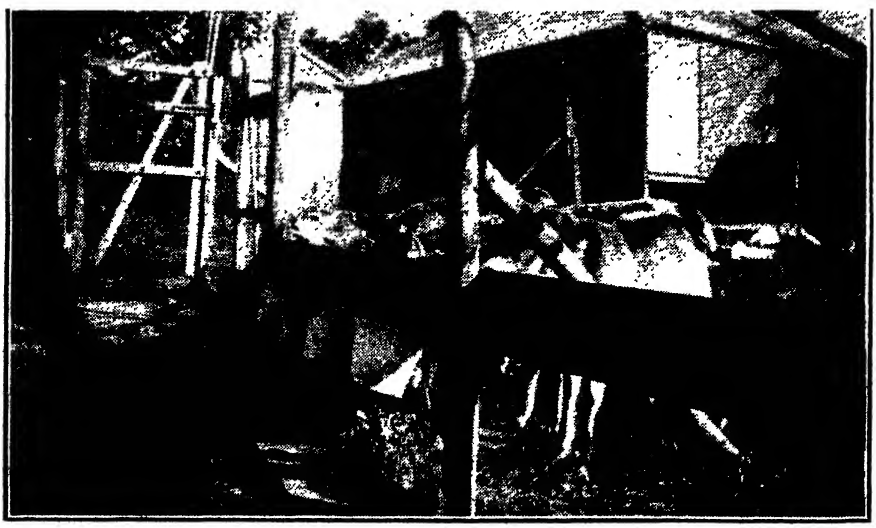
an important part in making the calf resistant to scours and similar infectious diseases. If the dam of a valuable calf dies soon after calving, an endeavour should be made to obtain some colostrum from another newly-calved cow.

Teaching the Calf to Drink.

Much difficulty often is experienced in training the calf to drink milk out of a bucket. This task is rendered much easeir by first allowing the calf to become properly hungry. Leave it without food for about 12 hours. If a hungry calf is allowed to suck the fingers dipped in the milk, it will soon learn to suck up the fluid. It should be taught to drink unassisted as soon as possible. One often sees quite large calves which will not drink without having a finger to suck. Such individual attention is an unnecessary waste of time.

Rubber Feeding Tubes.

Some breeders use rubber feeding tubes, through which the calves suck the milk from a bucket. It is claimed that the milk is thus obtained in a natural way, and is well mixed with saliva instead of being hurriedly gulped down. This argument appears very sound, and experiments which have been conducted indicate that calves reared with the aid of these rubber feeders are more thrifty and robust than their fellows fed directly from a bucket. These tubes cost about 3s. each (dozen lots), and last for several years if well cared for. It is imperative that these tubes should be kept scrupulously clean. Their use results in a saving of time.



An easy way of feeding Milk to Calves.
Use of Feeding Tubes at Mr. A. J. B. Strempel's Farm, Greenmount.

Should a Calf be fed three times a day?

Feeding three times a day probably gives somewhat better results with young calves, but it is very doubtful whether the extra trouble is warranted. If care is taken not to overfeed, twice a day feeding should prove effective. Care should be taken to feed the milk at as near blood heat as possible (98 to 100 deg. Fah.), or digestive troubles will occur, manifested generally by diarrhoea.

Quantities of Milk required by Calves.

Over-feeding is the most common mistake made in rearing calves. During the first week of its existence, a calf only requires 6 to 9 lbs. of its mother's milk per day. No benefit will result from feeding more than 9 lbs. The milk should be weighed occasionally to check the quantities being given. Three or four pounds of milk may not appear much to last a calf for half a day, but it is all that is required at this stage.

During the second week the allowance may be increased to from 9 to 11 lbs. of whole milk per day.

Use of Separated Milk.

Butterfat is valuable, and whole milk can be replaced gradually by separated milk after the second week. Some breeders prefer to rear promising calves almost entirely on whole milk. This practice is expensive as, although a calf fed on whole milk may appear somewhat sleeker and more attractive while young, experience has shown that, provided ample skim milk is available, such calves as yearlings are very little, if at all, superior in dairy development to others reared on separated milk.

Value of Separated Milk.

Skim milk is an extremely valuable food, as the act of separation removes only fat, which is used by the animal almost entirely as a source of heat or energy. All the body-building materials which make whole milk so complete a food for young growing animals still remain in the skim milk. If an easily digested energy providing food such as cereal grain is available as a supplement, whole milk may be replaced by separated milk without any check resulting to the calf.

The following table showing results obtained in an experiment on the feeding of calves, conducted at Woburn in England, illustrates this point:—

TABLE I.

Group.	Food.	Gain per Calf per week.	Cost per lb. gain in Live-weight.
		lb.	pence.
Lot 5	Separated Milk plus Crushed Oats fed dry ...	13·30	2·52
Lot 4	Whole Milk	12·83	5·39
Lot 2	Purchased Calf Meal in Separated Milk ...	8·66	2·77
Lot 3	Gruel (Linseed and Oatmeal) in Separated Milk	8·33	3·45

All calves received whole milk for the first three weeks.

Changing to Separated Milk.

Whole milk may be gradually substituted by skim milk during the third week, taking about a week to complete the change.

Concurrently with the addition of separated milk, a grain supplement, preferably crushed oats, should be fed. Where the calves have access to good green pasture, very little grain is required, as calves soon learn to nibble at available roughage.

Feeding Grain Supplements.

The best method to feed grain supplements is as a dry meal. Begin by placing a little dry meal in the bottom of the bucket after the milk has been consumed. A taste for the meal will soon be acquired.

The feeding of meals as a gruel is not recommended, as trials show that grain meals so fed are not so well digested as when fed dry. (See Table 1.) With dry feeding the calf has to eat slowly; the food is well chewed, and is thoroughly mixed with saliva before being swallowed. A gruel is swallowed quickly without any preliminary mastication. The feeding of a dry meal immediately after the milk ration does much to eliminate the desire to suck each other, and calves are easier to wean than when gruel fed.

Grain Meals to use with Skim Milk.

In preparing a supplement to use along with skim milk, it should be remembered that an easily digested starchy food is required. Skim milk is very rich in protein—the albuminoid ratio is 1 : 1½, as compared with whole milk 1 : 4. The practice of adding protein rich foods to skim milk for feeding young calves is expensive and dangerous, often resulting in serious digestive derangements. The best supplements consist of crushed cereal grains, crushed oats being a very popular constituent. Wheat bran adds greatly to the palatability of a ration, and is much used for this reason.

Commonly used supplements which may be recommended are:—

1. Crushed oaten grain.
2. Equal parts of crushed oats and wheaten bran.
3. Equal parts of crushed oats and crushed wheat.
4. Nine parts crushed oats, three parts crushed wheat, and one part linseed meal.

Linseed meal is sometimes used in small quantities, as it is much relished by calves and encourages them to eat the meal in the early stages of feeding. Linseed meal also has a tonic effect on the system and adds "bloom" to the appearance of animals receiving no green fodder. However, linseed meal should not constitute a major part of a skim milk supplement.

Gruels.

If it is desired to feed the supplement as a gruel, pollard may be recommended, using about half a pound per gallon of skim milk. Make into a porridge with hot water and then mix thoroughly with the milk

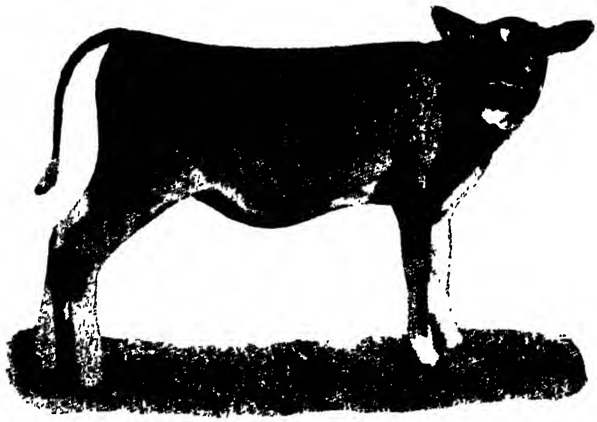
Pollard has a somewhat costive action, but this may merely counteract the tendency of skim milk to induce scours.

Allowance of Grain required.

During the third week a calf will only consume about a handful of grain. At five weeks about half a pound will be required. Subsequent increases will depend on the quality of the roughage available. It is rare that more than 2 lb. per day will be required up to the age of three months. Where calves have access to good green pasture and have ample skim milk, very little grain will be required. In the absence of green roughage, good hay should be made available, and, as the calf develops, the grain ration should be mixed with good quality chaff.

Management.

Calves always should be tied up or, preferably, be kept in calf bails during feeding. This is especially important when grain supplements are being used. Each calf should be able to eat its allotted share at leisure, without fear of being molested by its larger fellows. No definite table of weights of milk and grain to be given at specific ages can be supplied. This must be left to the judgment of the



The skim-milk age (one to six months).

feeder, who should study the individual requirements of his charges. However, the general plan to be followed in rearing a calf on skim milk is outlined hereunder:—

1st-2nd day.—Leave with dam, which should be relieved of surplus milk.

3rd-14th day.—Feed dam's milk at blood heat (98-100deg. Fah.). About 6 to 9 lb. per 24 hours is sufficient.

3rd-4th week.—Gradually substitute skim milk for whole milk. Commence grain supplement, using about a handful per day at first. Give access to good pasture if possible. Increase skim milk ration to about 13 lb. per day at end of 4th week.

5th week onwards.—If available, increase skim milk ration by about 2 lb. per week until 20 lb. per day is being given. The grain ration may be increased from ½ lb. per day at five weeks to 2 lb. per day at nine weeks. If pasture is not available, fresh meadow hay should be placed in accessible racks, and increasing quantities of chaff should be mixed with the grain ration. Where ample good pasture and skim milk are obtainable, little or no grain is required after the fifth week.

Always supply ample fresh water to calves at all ages.

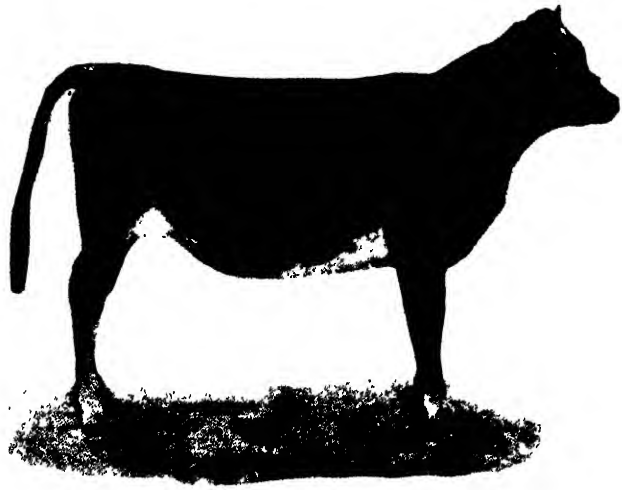
A calf should increase in live weight at the average rate of almost a pound per day during the first three months.

Weaning.

The time to wean will be determined by the amount of skim milk available. Benefit will be derived from skim milk up to seven months of age, but it is more common to wean at about five months old. Avoid weaning calves suddenly; give them a chance to learn to obtain their requirements elsewhere.

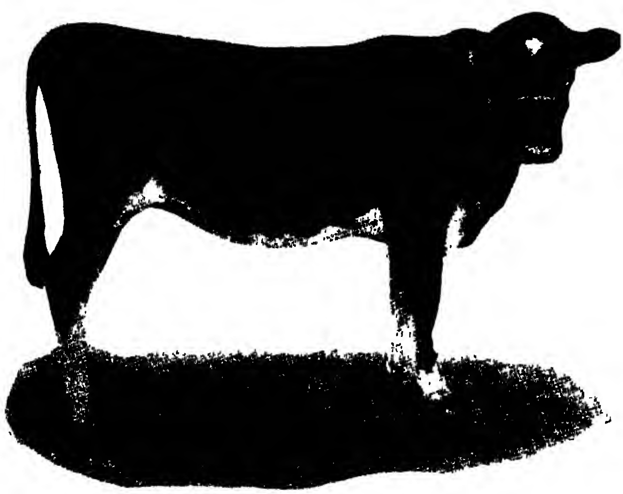
After Weaning.

This is generally the most trying period in the life of heifers. The rate of growth must be maintained by keeping them on good pasture; if green feed is not available, good hay should be supplied.



The oft-neglected age (six to 15 months).

Legumes (green and as hay) are of great value to calves after weaning, being rich in the proteins and mineral matter required by growing animals.



The breeding age (15 to 22 months).

On dry feed all stock should receive some suitable phosphatic lick to counteract the almost certain deficiency of phosphoric acid in such fodder.

Do not mate heifers too young. The best breeding age is between 15 and 20 months.

The Use of Milk Substitutes.

Dairymen who sell whole milk are handicapped in rearing calves insofar as no separated milk is available. Still it is desirable that the heifer calves from the top cows be reared to improve and maintain the herd, and this can be effected by the use of whole milk substitutes.

The calf should be fed for about two weeks on whole milk from its mother. This will occasion very little loss, as the colostrum or first milk is unfit for sale. During the third week, gradually replace the whole milk by a gruel so that at four weeks no whole milk is being fed. Various gruels may be used. Proprietary calf foods are often quite good, but it is generally cheaper to use a home-made mixture. Encourage the consumption of dry meals as soon as possible.

Substitutes for Milk.

When no skim milk is available, a gruel made from the following mixture serves as a good substitute. Mix three parts by weight of pollard with two parts of linseed meal. Use 3 lb. of this mixture to a gallon of water. Feed in the same quantities as directed for separated milk (page 66). Some dariymen prefer to use a higher proportion of linseed meal, but the ratio recommended should prove satisfactory.

Numerous other more or less complex mixtures of various grains and meals have been recommended, but the one given above seems the simplest and most suitable for Western Australian conditions. Where leguminous grains, such as peas or beans, can be obtained and crushed, these should be incorporated in the calf meal. Results have been quoted from New Zealand experiments, in which calves reared on bean meal grew even better than others fed on skim milk and cereal grains. The following mixture illustrates how peas (or beans) may be incorporated in a mixture:—

Linseed meal—2 parts Crushed peas—1 part Pollard—2 parts	2½ lb. per gallon of water fed as a gruel in the same quantities as recommended for separated milk on page 66.

Use of Dry Meals.

As soon as possible substitute "dry" feeding for the much more troublesome gruels. The methods used are essentially the same as described for calves fed on separated milk. During the third or fourth week, commence placing a little dry meal in the bottom of the calf's bucket after the gruel has been consumed. As the taste for the concentrate is acquired, increase the ration and feed proportionately less meal in the liquid form. It is better to dilute the gruel than to decrease the bulk supplied, as calves should be encouraged to drink ample water. Readily accessible supplies of fresh water always should be available to young calves.

Dry Meals to replace Separated Milk.

The meal here required is quite different from that fed to calves receiving ample separated milk. The proteins and mineral matter normally obtained in milk must be supplied in the supplements. A simple and very efficient mixture ("A") consists of equal parts of crushed oats and linseed meal. This approximates to the required albuminoid ration 1 : 4 and, when fed in conjunction with leguminous hays or young green pasture, should satisfy the needs of the growing animal.

A second mixture which can be recommended is:—

"B" Linseed meal—1 part by weight.
Crushed oats—1 part by weight.
Wheat bran—1 part by weight.

This mixture may prove cheaper, as less linseed meal is required, and may be more suitable than mixture "A" for very young calves, especially if the oats used are fibrous. If the oats have to be purchased, mixture "B" is recommended.

If crushed peas or beans are available, a well balanced meal may be prepared as follows:—

"C." Bran—3 parts by weight.
Peas—2 parts by weight.
Crushed Oats—2 parts by weight.

This may not prove so palatable as a mixture containing linseed meal, and could be improved by the addition of some of this concentrate.

The choice of a meal is determined by the relative cost of the various constituents and the nature of the roughage available. Good mixed pasture simplifies the problem, as it supplies most of the requirements of a young calf. Conversely, in the Wheat Belt, calves receiving only dry cereal roughage (say wheaten and oaten hay) will need a supplement rich in mineral matter. Bran or crushed wheat will supply ample phosphorus, but an additional source of lime will be needed. In the absence of leguminous roughages (which are rich in lime) it will be necessary to add 4 to 5 per cent. of ground limestone or slaked quicklime to the grain supplement.

During the period when whole milk is being reduced, the calves may show an appreciable loss of bloom, but, if a good meal is used, little check in the rate of growth will be noticed. Calves on milk substitutes may appear to lose ground during the fourth to seventh week when compared with those receiving separated or whole milk, but at the age of six months very little difference will be discernible.

GENERAL MANAGEMENT.

Having considered the problem of feeding, it is now necessary to refer to other factors of importance.

Cleanliness is essential. Calves must be kept in clean quarters and fed clean foods. Scours—a dreaded scourge of calves—is due almost invariably to faulty hygiene. The use of dirty buckets, unclean or stale milk, or soiled roughage, results in the distribution of disease germs among the pens. As scours may be contagious, infected animals should be isolated and the particular pen disinfected.

Digestive disorders also result from over-feeding, and feeding milk too hot or too cold, irregular feeding, and through exposing the calf to inclement weather.

Treatment of Scours.

When a case of scours occurs, at once reduce the milk fed by about half. In cases of bad attacks no milk at all should be given; merely supply boiled water cooled to blood heat. The restricted food supply will cause weakness, but will have no permanent deleterious effect. As the diarrhoea ceases, milk may be gradually reinstated in the ration. The addition of lime water to a reduced ration of milk is often effective in checking mild attacks of scours.

Calf Pens.

The ideal is to have a small pen for each calf, but this is seldom possible. Where a number of calves are running together, the use of calf bails greatly facilitates feeding and may be used to counter the nasty habit—common in calves—of sucking each other. Small bails are easily constructed, rough timber being quite effective.

Calf-feeding bails.

Each calf can here receive its allotted ration, and is detained until the desire to suck has passed away. Where meals or chaff are being fed, always give these immediately after the skim milk. This also helps to check the habit of sucking. If bails are not used, tie the calves up so as each one receives its fair share of food. It is common to see a number of calves of various sizes being fed from the one trough; under such conditions the large animals rob the smaller ones.

Shelter.

Calves should not be exposed to cold winds or excessive wet. A dry shed free from draughts and with clean straw for bedding should be provided.

Do not keep calves cramped up in small, badly lighted yards. Sunlight is of great value in killing pathogenic germs and stimulating good health. In summer time sufficient shade should be provided, but undue pampering should be avoided at all times.

Dehorning.

The dehorning of grade cattle generally is most desirable. Much suffering and many cases of severe loss result from cows goring each other. These daily feuds are unnecessary, as the horns can be prevented from developing by a simple operation soon after birth.

When the calf is about a week old, smear some vaseline or motor car grease around the small button or embryo horn which can be felt on the head. Do not put vaseline on the horn itself; the vaseline is to protect the surrounding skin. Then take a stick of caustic soda (purchasable from the chemist), moisten the end, and rub on each horn three or four times. Allow the caustic soda to dry between each application. Take care that the caustic is placed only on the horn and does not run or drop elsewhere.

The operation should not be performed in wet weather unless the calf is kept under shelter, as rain may wash the corrosive material from the point of application and endanger the eyes. With a little care, polled cattle can easily be obtained with little expense and practically no pain.

Steers.

Castration of male calves which are to be retained as steers should be done as soon as the testicles can be felt in the scrotum. The operation is simple, cleanliness being the main essential, and should be done while the calf is still young.

Conclusion.

Calf-raising can be made a very profitable phase of farm life. An owner tends to develop more interest in stock of his own breeding, and it is a source of justifiable pride to be able to say that the best cows in the herd were bred on the property. Breeding good livestock requires much skill and experience, but every owner of a dairy herd should develop such latent talent as he may possess by the use of a bred-for-production bull, and rearing the heifers from the best producers in the herd. By "grading up," a good herd can be evolved in a few years, but healthy calves are just as essential in furthering this object as are high quality breeding stock.

SOWING SUDAN GRASS UNDER IRRIGATION AS A COVER CROP WITH PASPALUM.

H. J. K. GIBSONE and G. GAUNTLETT, B.Sc.

Under irrigation the method of laying down a paspalum pasture in the spring with a cover crop such as Sudan grass, and the subsequent grazing of the latter commends itself, as the cover crop provides green feed for the stock during the dry summer months, while the paspalum is growing.

A noteworthy example of the above method of establishing a paspalum pasture this season in the new Harvey Irrigation Area has been that of Mr. L. Temple, 3rd St.

The following details were obtained from this farmer:—

Ten acres originally heavily timbered with wandoo were subdivided into four 2½-acre paddocks. The soil may be described as a sandy loam with a clay subsoil 6-8 inches from the surface.

The land, which was originally partially cleared and sown with subterranean clover six years ago, was ploughed during the first week in October, disc cultivated twice and then harrowed. During the first week of December it was ploughed into 4½ yard lands and harrowed, and finally rolled after planting the Sudan grass.

Sudan grass at the rate of 6lbs. per acre mixed with 1cwt. of B potato manure, was sown with the drill on December 15th. 6lbs. of paspalum and 1½ lbs. of white clover mixed with 1cwt. of super were sown per acre on December 30th, the seed used being obtained from F. H. Brunnings Pty., Melbourne. A very good germination resulted illustrating the advantage of using good viable seed so important in the establishing of a permanent pasture.

Watering.

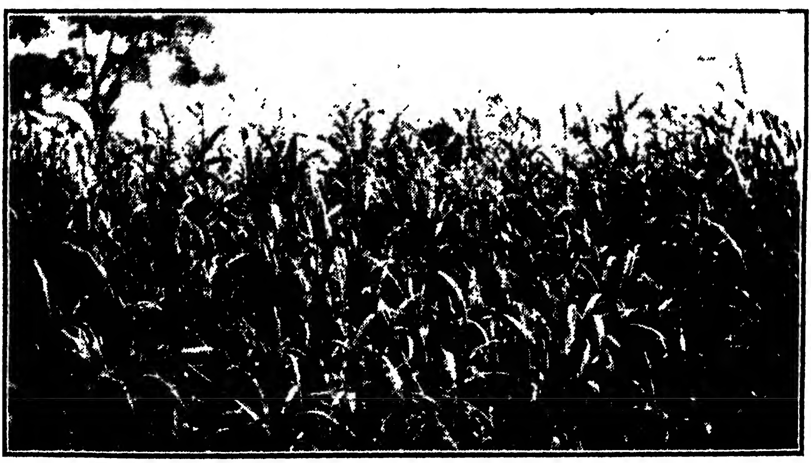
The crop was watered on December 22nd, 1932 (prior to the planting of paspalum and white clover) and again on January 15th, 1933.

The method used was the ordinary furrow system of irrigation, the water being conveyed from the main channel through a head ditch into the finishing furrows left at the last ploughing, which prior to irrigating were opened out with the plow. The flow of water in the furrows was regulated by means of 4-inch outlet boxes provided with shutters made of tin, enabling the amount of water through each to be easily controlled.

The scheme was laid out according to departmental specifications, the head ditch being made 2ft. wide on the bottom with a batter or side slope of ½ to 1, the top of the banks being 12 inches wide and at least 18 inches above the invert or bottom of the channel, which is approximately 9 inches below the natural surface level, and has a fall of ½in. to the chain. To maintain this grade, it was necessary to put in drops made of sandbags approximately every chain along the channel, owing to the heavy fall in the land.

Grazing was commenced in the first paddock on February 1st (six weeks after planting). 26 cows were turned in for two hours a day at first, and then later for four hours a day. The grazing lasted until February 9th, when a small residue of stalk was mown and given to the dry stock. The paddock was then watered on February 13th and chain harrowed when dry enough.

The other paddocks are receiving similar treatment.



Sudan Grass under Irrigation.

Some idea of the heavy growth of Sudan grass may be gathered from the accompanying photograph. The man in the centre of the picture is over 6ft. in height.

Grazing a tall crop is regarded as a doubtful expedient on account of wastage through trampling, etc. However, providing the crop is suitable and the cows are only left in from 1½ to 2 hours at a time, there should not be much loss, but it is not recommended to allow the crop to become so tall. The crop in question was left ungrazed longer than was anticipated on account of minor

troubles in connection with the watering. The fact that very few stalks were left illustrates the high palatability of Sudan grass.

There is no doubt about the feeding value of Sudan grass. The fellowing table shows the relation between it and Japanese millet, which also does well under irrigation. These analyses taken from crops in the same stage of growth and grown under similar conditions were obtained by the Department of Agriculture, New South Wales:—

	Sudan Grass.	Japanese Millet.
Moisture	51.0	55.35
Protein	7.25	5.95
Fat	1.22	1.04
Ash	5.16	6.44
Fibre	14.36	13.27
Carbohydrate	20.83	17.95

It is not wise to take anaylses at their face value, but they certainly indicate where conditions are the same, the relative merits of crops.

The value of a fodder crop or permanent pasture is necessarily determined by the increased yield of butter fat from the cows. Since grazing on the Sudan grass, Mr. Temple's cows have shown an increase of 100 per cent. The cows were, however, on dry feed prior to being turned into the Sudan grass. More direct benefit would have resulted if the crop had been planted earlier, say late in October. The cows would then have been on green feed immediately the clover had finished, and more bulk would have resulted from the season's growth. The time of planting is necessarily governed by seasonal and other conditions. It is therefore interesting to compare Mr. Temple's returns with the corresponding month in 1932, before he had irrigation on his holding:—

In February, 1932, without irrigation—22 cows gave 210lbs. butter fats, an average of 9.54lbs. butter fat per cow.

In February, 1933, with irrigation—21 cows gave 378lbs. of butter fat, an average of 18lbs. butter fat per cow.

The following shows the cost of seed and manure per acre of the crop and pasture:—

Paspalum, 6lbs. at 1s. 4½d.	8s. 3d.	per acre
Sudan Grass, 6lbs. at 5d.	2s. 6d.	„
White Dutch, 1½lbs. at 2s. 3d.	3s. 5d.	„
Super, 1cwt.	5s. 0d.	„
Potato Manure B, 1cwt.	8s. 0d.	„
Total Cost	27s. 2d.	per acre

Poor results were obtained with the white clover. A fair germination resulted, but the plants only reached the second leaf stage and then died. This was probably due to the heavy growth of Sudan grass shutting out the light and exhaling a great amount of carbon di-oxide in the process of respiration, and so suffocating the more delicate clover plants.

The method recommended in the establishment of pasture other than hardy plants like paspalum, is to sow without a rapid growing cover crop, and Mr. Temple intends to re-sow the white clover next spring.

Sudan Grass Poisoning.

As a certain amount of doubt still exists as regards the reputed toxic properties of Sudan grass, it may not be out of place here to quote a few notes from an article by Mr. Murray Jones, the late Chief Veterinary Officer, which appeared in the "Journal" of September, 1925.

In the course of his article, the author stated that—

"The evidence of poisoning is insufficient to warrant the condemnation of such a valuable fodder. It has been recognised that sorghum, to which Sudan grass is allied, does at the heading stage develop a very small amount of a cyanogenetic glucosede which fermentation gives an infinitesimal amount of prussic acid, so small however that it may be grazed at any time without danger.

There are, however, times when there may be a possible slight element of danger with Sudan grass:—

1. When the plant is stunted or slow growing.
2. When the crop is not pure but contains hybrids of Sudan and sorghum.

There is no danger of poisoning—

1. When plants have headed.
2. When cut or wilted before feeding.
3. When made into hay or ensilage.
4. When the crop makes rapid growth.

When stock are injudiciously turned on to succulent Sudan grass, trouble is to be expected not through prussic acid poisoning but through digestive troubles. Many of the deaths reputed to be caused by prussic acid poisoning have unquestionably been caused through digestive or mechanical troubles."

Summary.

In sowing Sudan grass under irrigation with or without a pasture plant, the following facts present themselves:—

1. Prepare a good firm seed bed.
2. Use good clean seed.
3. Do not sow too heavily; 8 to 10 lbs. per acre is plenty, if drilled. A heavier sowing is more expensive and the plants have not the same chance of stooling.
4. In addition to super, on soil deficient in humus, sulphate of ammonia would be beneficial.
5. Do not sow too late. More green feed is obtained per season when planted earlier, providing the land is warm enough at time of sowing to maintain normal growth.
6. It is advisable to graze the crop early, certainly before it is in flower. This causes the plants to stool more rapidly.
7. The stock should only be grazed for short intervals, say 1½ to 2 hours, otherwise digestive troubles such as hoven or bloat result.

Watering.—The following points are important:—

1. The head ditches should be well made according to departmental advice. A well made head ditch enables the farmer to control the water, and thus prevent wastage and over watering.
2. It is advisable to use outlet boxes. This also simplifies the control of the water.
3. Narrow lands, 4½ yards wide, are recommended.
4. Do not over irrigate. Wastage of water and over irrigation cannot be too strongly condemned.

SEEDS AND SEEDING.

G. R. W. MEADLY, B.Sc., Agricultural Adviser.

Seeds of all kinds, including agricultural, vegetable and flower seeds, are often a cause of considerable worry to purchasers. On occasions when poor germination and weak seedlings are obtained, there is a tendency to immediately condemn the seed as being of inferior quality. Although this may often be the case, there are a number of other factors which influence the germination and subsequent growth.

The awakening of a seed to produce a plant is dependent upon a combination of three external factors, viz., warmth, moisture, and oxygen. Each one of these may be described as a limiting factor, for the presence of any two to the exclusion of the third, will produce little or no germination.

TEMPERATURE.

The best or optimum temperature for germination varies considerably for different species, being more variable than any other factor. Those who have had practical farming or gardening experience have observed the different temperature requirements for good germination of seeds, and arrange their times of planting accordingly. Thus wheat and oats, which have a low temperature requirement, may be planted when the soil is comparatively cold, but in the case of maize and melons, which have a high temperature requirement, for good results planting should be carried out when the soil is warm. If maize is sown during the winter the seeds will usually decay and have to be replanted. As examples, the optimum germination temperature ranges for oats and maize are 77deg.-88deg. F. and 99deg.-111deg. F. respectively.

MOISTURE.

The amount of moisture required may be regarded generally as that which will completely saturate and soften the seeds. An important exception met with locally is in the case of the so-called "hard seeds" of a number of our agricultural seeds, particularly Drooping Flowered Clover, Cluster Clover and Lupins. Many seeds of these species have coats which are not immediately permeable, *i.e.*, do not absorb water even when it is present in optimum quantity. They germinate at intervals, some remaining "hard" for years but still retaining their ability to produce normal plants.

An excess of water is as serious and sometimes more so than a deficiency. In soils which are badly drained, the water-table may reach the surface of the ground, thus eliminating the soil atmosphere which is so essential to germination and growth.

A comparatively large amount of water is absorbed by seeds when they germinate, sometimes exceeding the dry weight of the seeds themselves. The variation of specific cases is again large for 100 lbs. of maize after being soaked for germination may weigh 144 lbs., whereas 100 lbs. of White Clover seed after soaking may weigh 226 lbs.

OXYGEN.

Although seeds are experiencing their optimum temperature and are properly supplied with moisture, only in very few cases will germination occur unless oxygen is available. Normal air contains about one-fifth oxygen so that the supply is ob-

tained by allowing access of air to the seed. In the field, sufficient air may be prevented from reaching the seeds by planting too deeply, or again by sowing in completely water-saturated soils which do not allow circulation of air.

RELATION OF FACTORS TO FIELD CONDITIONS.

(a) *Control of Temperature.*

When planting seed in quantity, the grower is largely in the hands of Nature where temperatures are concerned. Certain practices may be carried out, however, to improve the conditions. During the colder months planting on sunny hill-sides will increase the rate of germination and ensuing growth, and good drainage will also raise the average soil temperature.

(b) *Conservation of Moisture.*

Soil moisture may be conserved by fallowing and cultivating, thus producing a loose surface layer of comparatively fine tilth which protects the underlying soil from excessive evaporation. Mulching with stable manure, dead leaves, spent tannin bark, etc., considerably reduces water evaporation from the soil and may be employed in gardens and small plots during the drier months. Weed control also increases the amount of water available for crop plants for, during the summer in particular, loss of soil water from a paddock due to the presence of a large number of weeds is astounding.

(c) *Improving Aeration.*

Fallowing and cultivating also loosen and break up the soil, thus assisting the movement of air among soil particles and providing the necessary oxygen for germination and growth. Pastures, particularly those containing Paspalum, from time to time lose their growth vigour which is reinstated by a system of renovation. The pasture is ploughed, thus breaking the matted root system and providing aeration for the underground portions of the plants.

Lawns, particularly those used for games, such as tennis and bowls, become consolidated with the constant play and rolling to which they are subjected. Unless these are forked at intervals to assist aeration, the grass loses its green colour and tends to die out. Lawns may be classed as specialised permanent pastures and behave in a similar manner.

Farmers themselves sometimes actually induce adverse conditions by sowing too thickly. This applies particularly in the case of small seeded plants such as tobacco. When young seedlings are massed together there is a considerable amount of competition for light, air, and moisture. "Damping off" may occur and the seed-bed often becomes a veritable home for fostering fungal and bacterial diseases as well as insect pests. Again, when seedlings are clustered together, spraying to combat diseases or pests becomes a difficult problem, as application of the spray can be made only to a portion of the leaf surface. Thin planting and subsequent thinning are two factors which play a particularly large part in preventing outbreaks of Downy Mildew of Tobacco which is caused by a fungus, *Peronospora sp.* Initial care in this direction will save considerable time and expense later. By mixing with a suitable quantity of sand a more even and sparse distribution of small seeds may be made, particularly if sown through small holes made in the bottom of a tin.

When the conditions enumerated above are favourable and still a good germination does not occur, the source of the trouble is to be found definitely in the

seed. A general article entitled "Points in Purchasing Seeds" was included in the March issue of this *Journal*, and as several complaints have been received recently regarding seeds contained in packets, it is my intention in the following section to deal with "Packet Seeds."

PACKET SEEDS.

In order to obtain some idea of the actual value of seeds contained in packets, a number were bought from various seed merchants and then subjected to a complete test with the following results:—

Seedsman.	Seed.	Variety.	Purity.	Germination.	Good Average (eight years). Purity.	Good Average (eight years). Germination.
No. 1 ...	Parsnip	Hollow Crown	99·1	46	99·0	65
" ..	Pumpkin .	Queensland Blue ...	100·0	86	99·0	80
" ...	Tomato ...	Ealiana	100·0	94	99·0	85
" ..	Spinach ..	Prickly	98·9	72	99·0	50
No. 2 .	Cabbage . .	Succession	99·2	61	99·0	75
" .	Beet	Crimson Globe	99·4	65	99·0	65
" ..	Swede . ..	Laing's Garden ...	99·3	89	99·0	85
"	Carrot . ..	Early Horn	96·8	52	99·0	70
No. 3	Cauliflower .	Autumn Giant	95·7	94	99·0	70
" ...	Cabbage	Vanguard	99·8	75	99·0	75
" ...	Carrot . ..	St. Valery	99·1	79	99·0	70
" ..	Beet	Derwent Globe ...	99·5	35	99·0	65
No. 4 ..	Cauliflower	Autumn Giant	99·8	70	99·0	70
" .	Onion	Early White Globe ...	98·3	70	99·0	70
" ..	Lettuce .. .	Neopolitan	99·9	98	99·0	90
" .	Radish . .	Icicle	98·4	74	99·0	80

The germination figures in the good average column were compiled from results obtained over a period of the last eight years and, as stated, represent figures which may be expected from good average lines of seed. A general purity figure of 99.0 per cent. for all the seeds enumerated is satisfactory, conditionally that the impurities do not contain any serious weed seeds.

The purity of the lines received, taken as a whole, was quite good, only two of the sixteen being appreciably below the "good average" figure. The Autumn Giant Cauliflower from seedsman No. 3 contained a number of broken seeds which formed the main part of the 4.3 per cent. impurities. These broken seeds, if they germinate at all, give rise to malformed seedlings which do not survive. The Early Horn Carrot from seedsman No. 2 contained as its impurities broken seeds and small pieces of stick from the seed-bearing plants.

In the germination column, five of the sixteen are below the "good average" figures, six are considerably above them, and five approximately equal to them. Comparisons may be made between the cabbage seeds of seedsmen Nos. 3 and 2, which show 75 per cent. and 61 per cent. germination respectively, although the prices are the same. The difference between the beets of Nos. 3 and 2 is even more striking, thus demonstrating the large variation which occurs in the germination of packet seeds. Low germination is often associated with lack of vigour and the production of weak seedlings. Plants which are not strong and healthy in their young stages cannot be expected to produce satisfactory final results, no matter whether they are vegetables, agricultural crops or plants grown for decoration.

From the above table it may be seen that although the purity figures are generally satisfactory, the germination figures are not so consistent. Some are particularly good, while others are considerably below the figures calculated for good average lines. Firms which stamp figures for purity and germination on packets

give a guarantee which should be appreciated by seed buyers, as otherwise a certain amount of good fortune is entailed in obtaining satisfactory results from packet seeds.

The following table was compiled from results extending over the last eight years and represent good average figures for the vegetables listed, these being the most important packet seeds from an agricultural viewpoint. The fact that considerable seasonal variation sometimes occurs must be taken into consideration.

Figures for good average lines of Vegetable Seeds. (1932-33.)

Seed.	Germination %
Asparagus	65
Beans	90
Beet	65
Broccoli	75
Cabbage	75
Celery	60
Cauliflower	70
Carrot	70
Cress	90
Cucumber	85
Leek	75
Lettuce	90
Marrow	80
Melon	80
Onion	70
Parsnip	65
Parsley	60
Peas	90
Pumpkin	80
Radish	80
Rhubarb	60
Spinach	50
Squash	85
Swede and Turnip	85
Tomato	85

Impurities not to exceed 1 per cent.

BUTTER-MAKING ON THE FARM.

G. K. BARON-HAY, Superintendent of Dairying.

In view of the numerous inquiries received regarding butter-making on the farm, it is hoped that the following article will prove of interest.

It, however, should be remembered that, while it may be desirable to make butter for use in the home, the production of large quantities of farm butter for sale is neither in the best interest of the farmer nor of the Butter Industry as a whole.

Such butter, from its nature, cannot keep under ordinary conditions. It invariably realises a price lower than that of butter made from pasteurised cream.

The consuming public have no guarantee that such butter is free from disease germs; and, if it is found in large quantities on the market, it tends to depress the price of all butter offered for sale.

However, if the precautions set out below are followed, wholesome butter of good quality may be produced for use on the farm.

It is proposed in this article to deal briefly with the points necessary to observe for successful butter-making under farm conditions—from the drawing of the milk to the finished product.

Butter-making on the farm can only be carried out successfully during the cooler months of the year. In the hot months the prevailing temperatures are so high as to make successful farm butter-making a difficult matter, unless a really good supply of fresh, cool water is available, such as a spring or well, and even then the loss of fat in the butter milk is often very high. Early morning churning, when the cream and water will be at their minimum temperature, is strongly recommended under such conditions. Standing the can containing the cream in a tub of water over-night assists in reducing the temperature.

If a factory is within reasonable distance it is more economical to supply the cream to the factory during the hot months where temperature can be controlled in the proper manner.

BAD FLAVOURS IN BUTTER.

It is necessary for the butter-maker to recognise the unpleasant flavours in butter are caused, in the majority of cases, by bacteria or germs growing in the milk or cream and throwing down certain products which result in the development of unpleasant flavours in the butter. Milk drawn from the udder of a healthy cow is, practically speaking, free from germs which may affect the resultant butter. It is, therefore, during the milking process (on dust, hairs, etc.), while the milk is awaiting separation and during ripening of the cream (from the atmosphere—or dirty utensils) that germs gain access and start development.

Fortunately all germs do not produce unpleasant flavours. Some have the power of forming good acid flavours which assist in producing the sharp, clean pleasant flavour in the resultant butter so much desired by all butter-makers. If it is remembered that all bad germs are closely associated with *uncleanliness* and dirt, the necessity of producing and holding cream under perfectly clean conditions will be fully recognised, if a really first class article is to be manufactured.

POINTS TO BE OBSERVED AT MILKING TIME.

Buckets used for milking should be perfectly clean. Scouring thoroughly with hot water and washing soda once a week, in addition to the usual daily washings, will lengthen the life of the buckets and help to keep them in good condition. Utensils should be dipped in scalding water before use, even though apparently clean.

The udder should be wiped over with a damp cloth to remove dust and dirt, which would otherwise fall into the bucket during milking.

The first stream of milk from each teat should be discarded and not used.

No matter what precautions are taken, a certain amount of dust and hair from the cow's body will get into the milk, and it is necessary to remove this by straining the milk when pouring into the vat from milking bucket.

SEPARATION

Separation should be done as soon as possible after milking, while the milk is still warm, not less than 90deg. F. being desirable.

If the milk is allowed to cool, it will be necessary to heat it again before passing through the separator, otherwise a complete separation of the fat will be difficult to obtain and a higher amount than necessary will pass into skim milk.

There is also another reason for immediate separation. The separator acts to a certain extent as a remover of foreign matter, etc., which is deposited in the bowl with "separator slime," and the sooner this is removed from the milk the better chance will tbe cream have of developing into a first class article.

The separator should be thoroughly washed after *each* separation and the parts kept in a clean atmosphere where they can drain easily.

On no account should the cream from one milking be separated directly on to the cream from the previous milking. The cream from each milking should be kept separate until cooled somewhat; then they may be mixed and stirred thoroughly so that an even and uniform ripening will occur.

During the summer months it is necessary to cool the cream immediately after separating, if a first class butter is to be manufactured. This can be done by standing the can which contains the cream in a large vessel containing cool water, stirring the cream at frequent intervals to aid cooling. Several excellent small coil cream coolers are on the market, and their use is recommended to all dairymen.

CREAM RIPENING.

Cream is fit to churn when it has developed a certain amount of acid, and in the summer this usually takes from 24 to 30 hours, and in the winter up to 48 hours.

The acid can be detected by—

1. Taste and smell.
2. Consistency—an acid cream appearing much thicker than a fresh cream.
3. On stirring it will present a shiny surface, which is not noticed in a fresh cream.

Cream should be stirred three times a day during the ripening process to obtain an even development.

CHURNING.

Before use, the churn should be scalded and cooled thoroughly—with water.

The churning temperature of the cream is important, and in the hot months should be 50 to 54 degrees Fahrenheit if possible, and during the autumn from 56 to 60 degrees Fahrenheit. A dairy thermometer should always be used for checking the temperature in butter-making, and can be purchased for approximately 2s. 6d. When the butter begins to make its appearance in very small grains, stop the churn and wash down the sides and lid with a small amount of cold water (two degrees below the churning temperature of the cream, if possible). This helps the butter to form into proper grains, which allows churning to be continued until all the butter possible is obtained.

Continue churning until the grains have reached the size of wheat grains. Churning is now complete.

WASHING THE BUTTER.

Draw off the butter milk and add plenty of cold water (if possible about two degrees below the churning temperature). This is the first wash water. Draw this off and add a fresh lot of water. The object of these washings is to

wash out all the butter milk, and as a rule two washings will be found sufficient for this purpose, *provided the butter is in the granular form stated above.*

SALTING.

The butter may be salted in two ways—

1. In the churn, by adding a strong brine solution.
2. On the table, by adding salt.

BRINE SALTING.

This method is probably advantageous in the summer months with small lots of butter—as the brine solution will have the effect of lowering the temperature and firming the butter.

The method of procedure is as follows:—

Add a strong brine solution to the churn immediately after the second washing has been drawn off—while the butter is still in the granular form—and mix thoroughly—allow to stand for five minutes—draw off brine and add fresh brine solution as before and allow to stand for five or ten minutes; then draw off and work in the usual manner. With this method the butter can only be lightly salted, and it may be found that the butter is not sufficiently salted for requirements. It is the more expensive method of the two, as more salt is required for the brine solution than is used in salting on the table.

SALTING ON THE TABLE.

The butter is removed from the churn after the second washing, while still in the granular form.

Salt is added to suit the taste, but half an ounce of salt to one pound of butter may be taken as a guide to suit requirements. Use the finest ground salt obtainable and distribute evenly over the butter.

WORKING.

The object of working is to work in the salt and work out the excess moisture. This may be done with the ordinary butter worker but, if this is not available, the butter can be worked with a pair of pats (Scotch hands) well scalded and cooled beforehand to prevent them sticking to the butter. Working is complete when the salt has been thoroughly worked in and the butter brought into a compact mass.

If the butter is required to be kept some time "boric acid" preservative may be added with the salt, but care must be taken not to add more than a quarter of an ounce of boric acid to four pounds of butter.

PACKING.

Pack the butter neatly and evenly, and keep in a cool place free from odours.

Such articles as fish, meat, fruit, onions, oils, kerosene, paints, etc., will taint butter, and on no account should they be stored near each other. If it is desired to store butter for a month or two for home use, it is advisable to provide earthenware jars. Cleanse thoroughly, fill with butter, well packed to within an inch of the top, then add a layer of damp salt. Next pour a layer of melted butter over the salt, cover with a piece of parchment paper and store in a dry cool place.

THE M. T. PADBURY TROPHY COMPETITION.

I. THOMAS,

Superintendent of Wheat Farms.

This competition, which has been conducted for the past three years, was inaugurated as the result of a generous donation made by Mr. M. T. Padbury, a prominent pioneer farmer of the Moora district, and will extend over a total period of ten years.

The allocation of the funds has been so arranged that a replica of the main shield is awarded each year to the competitor who that year produces the highest acre yield per inch of rainfall during the growing season (May 1st to October 31st).

The conditions under which this competition will be conducted are as follow:—

1. The Competition will commence with the 1930/31 harvest and continue for a period of 10 years. At the end of that period the Trophy will be awarded to the competitor who has taken part in the Competition for at least five years, and who obtains the greatest mean average acre yield per inch of rainfall during the conventional growing period. The mean average yield will be computed from the results of the five seasons in which the competitor produced the highest acre yield per inch of rainfall during the growing period. In the event of a tie, the Competition will continue between the leading competitors until an advantage is gained by one of them.
2. The conventional growing period for any year will be that decided upon and announced by the Royal Agricultural Society. For the first year and until further notice, it has been decided that it will be from May 1st to October 31st, inclusive.
3. Until the end of the Competition the Trophy will be in the custody of the Royal Agricultural Society, and will be displayed at any agricultural exhibition held by that Society.
4. Each year the competitor who obtains the best average acre yield per inch of rainfall during the conventional growing period will be awarded a replica of the Trophy. His name will also be inscribed upon a small shield affixed to the Trophy.
5. The rainfall upon which the award will be made will be determined by the Commonwealth Meteorologist from the district records and his decision in this matter will be final.
6. The Competition will be limited to those farmers who harvest at least 200 acres of wheat for grain. Where a competitor is financially interested in the crops grown on one or more farms, he will be required to supply details regarding the production and marketing of the crops on same, and though usually the award will be made upon the results from the farm nominated by the competitor, yet the Royal Agricultural Society may require that the crops on these farms be included in the competing area.
7. The average yield will be ascertained from the total area—including self-sown crops—harvested for grain and determined from the actual amount of wheat sold as shown by the delivery dockets, plus the amount retained for seed, for home use or for any other purpose.
8. The method of judging will be as follows:—At a convenient time the area harvested for grain will be measured and the quantity of wheat on hand ascertained. On or before January 31st, the farmer will be required to

furnish the judge with a sworn declaration as to the quantity of wheat sold from the competing holding or holdings, and the amount retained for seed and other purposes; the statement regarding the amount sold to be supported by agents' dockets. The judge, after satisfying himself as to the correctness of this statement, will compute the average yield per acre per inch of rainfall during the growing period from the information received.

9. The judge will be appointed by the Director of Agriculture, and his decision will be final.

10. Nominations for this Competition will be received by the Royal Agricultural Society up to the 31st October each year.

The winner this year was Mr. O. J. Butcher of Pithara, who obtained an average of 2 bushels 42 lbs. per inch of rainfall over an area of just over 600 acres. He was closely followed by Mr. L. T. C. Barnett of Walgoolan with 2 bushels 34 lbs., and Hon. T. Moore, M.L.C., of Indarra, with 2 bushels 33 lbs.

Last year's winners were Messrs. F. M. and J. L. Atkins of Jouerdine, with an average yield of 3 bushels per inch of rainfall. The previous year, the competition was won by Mr. F. A. Williams, of Mangowine, with an average of 3 bushels 23 lbs. per inch of rainfall.

The results for 1932 are set out in the following table:—

M. T. PADBURY TROPHY COMPETITION, 1932.

Competitor.	Address.	Rainfall during growing period.	Area harvested.	Yield. Gross.	Yield. Average per acre.		Yield. Average per 1 inch of growing period rain.	
		points.	acres.	bus.	bus.	lb.	bus.	lb.
Butcher, O. J.	Pithara	1,157	609	19,001	31	12	2	42
Barnett, L. T. C. ...	Walgoolan	1,230	393	12,370	31	29	2	34
Moore, T., Hon.	Indarra	1,161	261	7,745	29	40	2	33
Nottage, R. B.	Tammin	1,335	340	10,704	31	29	2	21
Evans, L. D.	Nukarni	1,077	332	8,397	25	18	2	21
Manuel, C. J.	Mukinbudin ...	961	366	7,327	20	1	2	5
Scadding, N. A. ...	Kulin	1.535	482	15,308	31	46	2	4
Bishop, H. F.	Lake Grace ...	1,361	200	5,415	27	5	1	59
McLennan, Est.	Borden	1.334	253	6,452	25	30	1	55
Stewart, W. B.	Gnowangerup ...	1,412	283	7,608	26	53	1	54
Bremner, J. R. & Sons ...	Corrigin	1,494	917	24,660	26	54	1	48
Morcombe, P. T. ...	Waddy Forest ...	1,415	403	10,275	25	30	1	48
Creagh Bros.	Kwelkan	1,098	1,039	19,526	18	48	1	43
Williams, F. A.	Mangowine ..	930	356	5,196	14	36	1	34
Prowse, C. W.	Doodlakine ...	1,281	623	12.257	19	40	1	31
Richardson Bros. ...	Bonnie Rock ...	965	333	4,649	13	58	1	27
Richards, A.	S. Caroling-Dangin	2,080	226	5,388	23	50	1	9
Horsman and Sons ...	Bilbarin	1,781	350	6.733	19	14	1	5

BETTER DAIRYING COMPETITION, 1933.

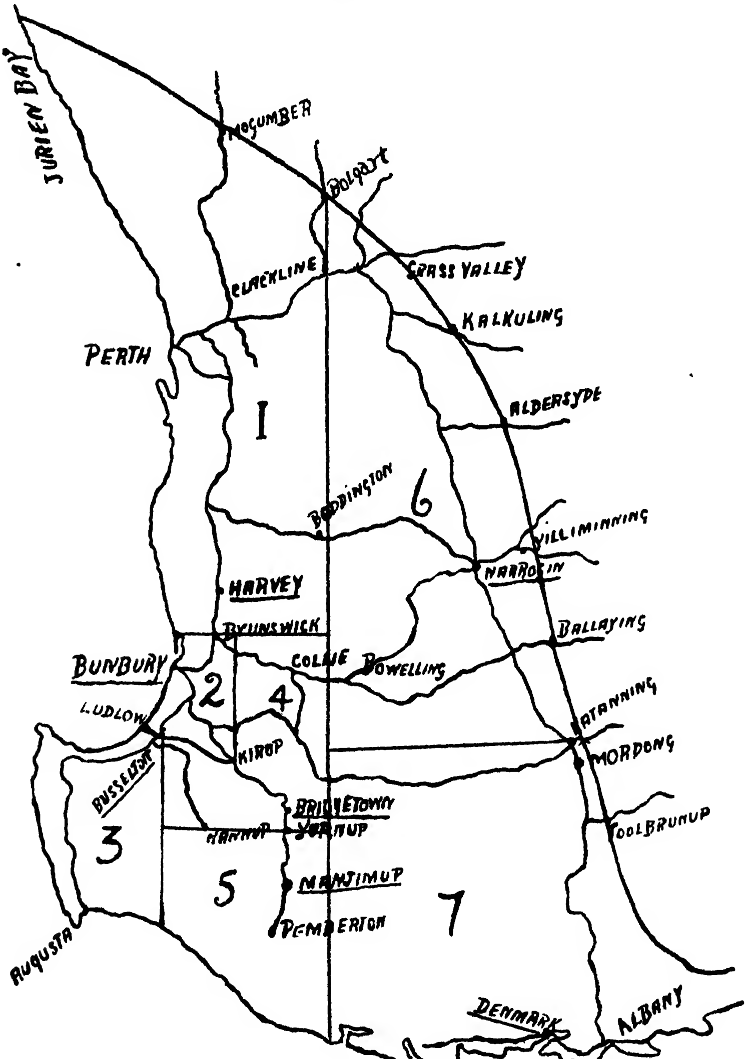
G. K. BARON-HAY, Superintendent of Dairying.

So encouraging were the results of the Better Dairying Competition which was conducted last year, that the Western Australian Committee of the Australian Dairy Council decided to conduct a similar competition for the season 1932-1933, the judging to be carried out again by the officers of the Dairy Branch, Department of Agriculture.

The plan of the competition was similar to that of last year, with variations in detail, as a result of the experience gained from the first competition.

For the purposes of the competition the Clover or Dairy Belt (*i.e.*, land enjoying a rainfall of 20 inches or more) was divided into seven zones, as shown on the following map, and in these sub-divisions an endeavour was made to group farms under as identical conditions as possible.

Illustration 1.



Note.—The Southern boundary of Zone 6 is now a direct line through Mt. Barker.

The objective of the W.A. Committee of the Australian Dairy Council is to encourage the development of pasture, fodder crops, and the conservation of fodders. With this end in view the farms were so judged as to make all phases of the farm practise subservient to these considerations.

Thanks are due to the Central Agricultural Societies in each zone, namely, Harvey, Bunbury, Busselton, Bridgetown, Manjimup, Narrogin and Denmark, whose committees co-operated with the Department of Agriculture and the Dairy Council in distributing literature and receiving entries. Of special value also was the advice of Mr. P. Rose, who assisted in framing the schedule of points for the purpose of judging.

CHAMPION DISTRICT SHIELD.

An innovation has been made possible this year through the generosity of Cuming Smith-Mt. Lyell Farmers' Fertiliser Company, who donated a beautifully designed shield to be awarded to the district having the four leading farms. The shield is to be competed for during five years, and finally held by the district winning the shield the greatest number of times during that period. (Illustration 2.)

Illustration 2.

Shield donated by Cuming Smith Mt. Lyell Farmers' Fertilser Co.
To be held by the zone containing the four leading farmers.

The main headings under which competitiors were judged and points allotted were as follows:—

	Total.
1. **Farm Management.**—Includes lay-out and convenience, general management, sanitation; Book-keeping and records	75
2. **Dairy Herd.**—Includes system of breeding, dairy type and condition; herd sire, breed and conditions of pigs	100
3. **Pasture and Fodder Crops.**—Includes condition of pasture—management; fertilising and type-character, and cultivation of fodder crops	100
4. **Fodder Conservation.**—Includes silage, type, mixture, percentage waste; Hay, type and condition. Amount of conserved fodder per head of dairy stock and convenience for feeding	150
5. **Separated Milk.**—Utilisation of for calves, pigs, fowls, etc. ..	25
6. **Butter Fat Production.**—Includes production January to December, 1932; production per acre	50
Grand Total ..	500

A perusal of the above schedule will disclose the great importance attached to pasture, fodder crops, and fodder conservation by the Committee, as half the total points are allotted to these items.

Owing to the large area covered by the Competition, which provided varying climatic and seasonal conditions and rainfall ranging from 20 inches to 70 inches, it was found necessary to judge the farms in zones at different periods of the year, as folows:—

Zone 1.—Centre, Harvey—After December 1, 1932.

Zone 2.—Centre, Bunbury—After January 1, 1933.

Zone 3.—Centre, Margaret River—After December 15, 1932.

Zone 4.—Centre, Bridgetown—After January 15, 1933.

Zone 5.—Centre, Manjimup—After January 15, 1933.

Zone 6.—Centre, Narrogin—After February 15, 1933.

Zone 7.—Centre, Denmark—After January 15, 1933.

The Committee of the Australian Dairy Council decided to increase the prizes offered as follows:—

First Prize in each Zone—£12.

Second Prize in each Zone—£7.

Third Prize in each Zone—£5.

Fourth Prize in each Zone—£3.

In Zone 6, Centre Narrogin, where a "Fodder Conservation Competition" only was conducted, special prizes as under were donated:—

First Prize, £10.

Second Prize, £7.

Third Prize, £5.

Fourth Prize, £3.

The following tables, 1 to 7, set out in detail the points obtained by each competitor in the various zones.

TABLE 1.—POINTS GAINED BY COMPETITORS.

Zone 1.—Centre Harvey Agricultural Society.

Judge: H. G. Elliott, Agricultural Adviser, Dairy Branch.

———	Max. Points.	S. F. Russell.	T. Briggs.	H. J. W. Masters.	S. Bowers.	L. Temple.	A. E. Clifton.
FARM MANAGEMENT—(75 points).							
(a) Lay-out and Conveniences	30	29	19	24	15	22	18
(b) General Management, including Sanitation, etc.	25	23	16	19	16	21	14
(c) Book-keeping and Records	20	20	15	16	9	9	5
2.—DAIRY HERD—(100 points).							
(a) Breeding—System of	25	23	23	20	21	22	18
(b) Dairy Type and Conditions	30	26	26	23	26	25	20
(c) Bull (give particulars of breeding and production ancestry)	25	25	25	20	20	25	18
(d) Pigs—Breed, condition, etc.	20	18	17	10	18	20	14
3.—PASTURE AND FODDER CROPS—(100 points).							
(a) Pasture	60	† 85	37	† 71	37	† 74	† 59
(b) Fodder Crops	40	† 71	38	...	22	† 69	...
4.—FODDER CONSERVATION—(150 points).							
(a) Silage—							
1. Succulency	20	...	20	18	20	...	18
2. Mixture	20	...	17	17	18	...	17
3. Type of Silage	10	...	9	8	8	...	8
4. Percentage Waste .. .	20	...	16	17	17	...	14
(b) Hay—							
1. Mixture	20	19	16	18	18	...	18
2. Condition	20	19	13	18	18	..	10
(c) Amount of Fodder conserved per head	20	20	14	13	8	7	7
(d) General Lay-out for convenience in feeding	20	19	15	16	13	15	15
5.—UTILISATION OF SEPARATED MILK FOR PIGS, POULTRY, ETC.—(25 points).							
(a) Pigs	20	*20	*16	*10	† 19	20	† 20
(b) Poultry	5	5	4	3	4	4	4
6.—BUTTER FAT PRODUCTION (per acre) ...	50	50	18	38	44	46	21
	...	115	300	90	110	89	200
Total	500	472	384	379	371	369	318

*Partly or wholly on the whole milk trade. † Calculated on a *pro rata* basis.

TABLE 2.—POINTS GAINED BY COMPETITORS.

Zone 2.—Centre Bunbury Agricultural Society.

Judge: M. Cullity, Agricultural Adviser, Dairy Branch.

—	H. Noon, Katterup.	P. Rose, Burekup.	Norton Bros., Capel.	J. Hearman, Donnybrook.	A. Trigwell, Donnybrook.	W. J. Sears, Donnybrook.	J. H. Brett, Dardanup.	Dunkley Bros., Capel.	L. A. Poad, Dardanup.
FARM MANAGEMENT.									
Lay-out	22	25	16	19	14	21	23	13	21
General Management ...	21	25	19	17	15	21	23	17	18
Books and Records ...	16	15	18	12	5	12	12	15	7
DAIRY HERD.									
Breeding	22	25	19	10	22	18	18	21	20
Dairy Type and Condition	25	28	23	22	28	25	24	25	23
Bull	22	25	23	21	21	22	17	25	25
Pigs	20	20	10	5	12	3	10	4	10
Pasture	50	47	57	41	44	42	37	55	40
Fodder Crops	15	2	3	4	...	...	40	...	19
Silage—									
Succulency ...	17	16	17	18	18	19	..	20	...
Mixture	16	16	16	18	15	17	...	20	...
Type	8	7	7	9	9	9	...	10	...
Waste	12	6	15	18	10	14	...	16	...
Hay—									
Mixture	18	16	17	18	17	15	20	19	18
Condition	17	18	20	17	17	15	17	20	18
Amount per head .	30	33	27	49	44	49	47	18	19
Convenience in feeding	13	19	17	17	14	14	19	14	14
Skim Milk and Poultry	21	20	19	12	17	15	16	17	16
Butter Fat (per acre)	34	22	33	38	49	37	39	26	34
Total Points ...	399	383	381	374	371	368	362	355	302

Illustration 3.

Mr. A. Trigwell's herd, Donnybrook.
This herd produced 64 lbs. of fat per acre, the highest in Zone 2.

TABLE 3.—POINTS GAINED BY COMPETITORS.

Zone 3.—Margaret River and Busselton Agricultural Society.

Judge: C. GILES—Dairy Instructor. Dairy Branch.

—	Max. Points.	C. H. Ironmonger.	A. Miller.	H. Eddy.	A. Oldfield.	E. C. Melville.	J. J. Burge.	S. Smith.	A. W. Langly.	M. Torrent.	J. A. Doyle.	W. J. Bryant.	Reading Bros.	W. J. Johnston.	G. Dallas.	D. O. Briggs.	—. Beacham.	J. Angell.	H. Fisher.	W. Still.	N. Short.	J. W. Marshall.	M. R. May.
1. FARM MANAGEMENT—(75 points.)																							
(a) Lay-out and Convenience	30	20	26	24	28	21	25	29	22	18	24	24	22	22	20	18	20	18	20	20	18	16	18
(b) General Management, including Sanitation, etc.	25	20	22	22	22	18	22	25	16	14	16	20	17	15	18	17	16	15	22	16	16	16	16
(c) Book-keeping and Records	20	17	18	16	18	18	16	18	15	17	18	15	18	18	15	15	15	18	15	12	15	15	15
2. DAIRY HERD—(100 points.)																							
(a) Breeding—System of	25	25	20	20	20	25	22	22	18	15	15	20	22	20	20	20	10	20	20	20	20	20	20
(b) Dairy, Type and condition	30	28	24	26	22	22	24	28	22	20	16	24	20	16	19	22	17	17	22	18	17	16	17
(c) Bull (give particulars of breeding and production ancestry)	25	25	25	25	25	25	25	25	25	15	15	25	25	25	25	25	15	25	25	25	15	25	25
(d) Pigs—Breed, condition, etc.	20	16	18	19	18	18	18	16	18	18	18	18	15	16	19	18	16	15	16	18	16	18	16
(3) PASTURE AND FODDER CROPS—(100 points.)																							
(a) Pasture	60	56	56	54	50	42	40	58	54	45	42	55	40	35	50	42	42	60	50	55	50	40	40
(b) Fodder Crops	40	8	8	...	2	18	15	...	7	20	30	11	11	12	5	20	11	3	...	6	8	5	12
4. FODDER CONSERVATION—(180 points).																							
(a) Silage:—																							
1. Succulency	20	18	18	17	18	16	18	...	14	15	14	...	18	16	16	...	15	...	...	...	12	20	...
2. Mixture	20	20	20	20	20	18	20	...	20	15	16	...	20	20	15	...	15	...	...	...	18		...
3. Type of Silage	10	9	9	9	9	9	9	...	8	7	8	...	9	9	7	...	7	...	...	...	5		...
4. Percentage of Waste	20	14	14	15	14	14	12	...	11	10	12	...	15	10	8	...	10	...	...	...	5		...
(b) Hay:—																							
1. Mixture	20	18	18	17	18	18	18	18	18	18	17	18	17	18	16	17	17	16	18	17	18	16	17
2. Condition	20	16	18	16	16	15	18	18	16	15	16	16	16	17	16	15	16	14	16	16	16	15	17
(c) Amount of Fodder conserved per head ...	50	45	40	28	42	26	50	50	30	33	33	45	16	26	30	25	33	28	30	30	15	16	28
(d) General lay-out for convenience in feeding	20	12	14	12	13	14	14	18	12	12	12	12	14	12	12	12	14	12	12	14	12	10	12
5. UTILISATION OF SEPARATED MILK FOR PIGS, POULTRY, ETC.—(25 points).																							
(a) Pigs	20	20	12	20	20	20	3	20	15	20	20	20	20	20	20	20	20	20	18	20	14	20	20
(b) Poultry	5	2	3	3	3	3	3	4	2	4	3	3	3	4	3	4	4	4	3	2	2	4	2
6. BUTTER FAT PRODUCTION—(62 points).	62	38	42	61	27	44	27	41	44	54	31	45	32	34	27	35	11	36	33	28	17	34	18
Acres devoted to Dairy Farming	...	110	100	68	100	103	125	68	120	60	50	58	250	65	56	55	100	47	98	56	75	70	120
Total	...	427	425	425	405	404	399	390	387	385	376	371	370	365	361	325	324	321	320	317	309	306	293

TABLE A.—POINTS GAINED BY COMPETITORS.

Zone 4.—Centre Bridgetown Agricultural Society.

Judge: M. CULLITY, Agricultural Adviser, Dairy Branch.

—	A. Hayward.	H. E. Kendal.	A. Lindsay.	V. A. Doust.	G. E. White.	F. C. Wiseman.	F. O. Nelson.	G. H. Dixon.
FARM MANAGEMENT.								
Lay-out and convenience ..	23	20	21	20	19	20	25	21
Management and Sanitation ...	18	20	17	20	19	16	24	20
Records and Book-keeping ...	12	15	8	16	9	11	...	13
DAIRY HERD.								
Breeding—System of	19	21	19	21	19	20	22	20
Type and Condition	23	25	23	26	26	28	25	25
Bull	22	22	23	23	19	17	24	23
Pigs	11	1	10	1	20	...	16	16
Pasture	41	39	40	47	42	38	43	39
Fodder Crops	..	9	3	...	2	2	..	11
Silage:								
Succulency	19	17	19	20	17	19	..	...
Mixture	18	17	20	20	15	19	..	...
Type	10	8	10	10	7	10	..	..
Percentage Waste	11	10	19	16	14	18	...	...
Hay:								
Mixture	20	18	19	19	16	18	19	17
Condition	20	18	20	20	19	12	19	16
Amount of Fodder conserved per head	37	50	39	17	23	8	20	15
General Lay-out for convenience in feeding	17	12	14	14	12	10	20	10
Skim Milk—Utilisation .	15	12	10	10	17	7	18	11
Butter Fat per acre	36	32	29	25	28	35	29	43
Total Points	372	366	363	345	343	308	304	300

Illustration 4.

H. C. Barnsby, Clovelly Farm, Pemberton.
Feeding Millet.

TABLE 5.—POINTS GAINED BY COMPETITORS.

Zone 5.—Centre Manjimup Agricultural Society.

Judge: M. Cullity, Agricultural Adviser, Dairy Branch.

—	H. C. Barnaby.	S. Gray.	H. Brown.	G. F. Combe.	B. Young.	Mr. & Mrs. H. Grum-pelt.	H. F. Jay.	Mrs. Arm-strong.	W. Cox.	A. V. Kjell-gren.
FARM MANAGEMENT.										
Lay-out, etc.	20	21	19	22	20	18	18	18	16	25
Management and Sanitation	24	24	18	23	23	23	21	19	19	25
Books and Records ...	18	5	13	10	5	15	17	10	5	7
DAIRY HERD.										
Breeding—System ...	18	18	20	25	17	22	17	15	17	19
Dairy Type and Condition	24	27	24	28	22	25	21	18	20	22
Bull	17	17	25	25	23	24	25	12	23	22
Pigs	15	12	2	8	10	4	20	3	1	1
Pasture	41	49	42	38	39	38	39	34	34	41
Fodder Crops	35	33	21	...	...	...	35	20	...	...
Silage—										
Succulency ...	20	18	20	20	19	18	...	20	19	17
Mixture	19	15	20	17	20	17	...	20	19	17
Type	9	9	10	9	10	10	...	10	9	7
Percentage Waste ...	18	18	18	18	19	12	...	15	17	10
Hay—										
Mixture	19	18	18	17	19	19	19	17	18	16
Condition	19	19	17	17	19	20	18	18	19	17
Amount Fodder conserved per head ...	50	50	50	50	49	36	41	46	49	40
General Lay-out for convenience in feeding...	17	13	16	19	17	14	15	15	18	14
Skim Milk—Utilisation	22	16	10	16	12	12	16	10	12	14
Butter Fat (per acre) ...	36	32	31	22	32	23	26	27	26	26
Total Points ...	441	412	394	380	375	358	348	347	341	340

ZONE 6—CENTRE NARROGIN.

This Zone (see Map Illustration) embraces land lying either side of the Great Southern Railway from approximately Northam to Mt. Barker, the rainfall being from 20-25 inches. Whilst primarily considered as suitable for oats and sheep, the production of butter fat has approximately doubled during the last three years. The most important factor for successful dairying in this area is undoubtedly **Fodder Conservation.** The Committee therefore decided to conduct a special "Fodder Conservation Competition" in this zone, under the following conditions:—

		Points.
Fodder conserved per head of dairy cows		50
Use of Phosphatic Licks		25
Silage—		
Mixture	20	
Type and Palatability	30	
Percentage Waste	30	
Time of Cutting	10	
Workmanship, Finish	10	
	——	100
		175

Where summer fodder is grown to replace silage, these crops to be judged on the following scale of points:—

Yield based on food value per acre ..	50
Freedom from weeds	15
Cultivation	15
Disease, freedom from	10
Evenness of growth	10
	100

Where both silage and summer fodders are provided, the scale of points to be halved in each case, so that the total shall remain 100.

TABLE 6.—POINTS GAINED BY COMPETITORS.

Zone 6.—Centre Narrogin Agricultural Society.

Judge: H. G. Elliott, Agricultural Adviser, Dairy Branch.

—	Points.	W. G. Burges, York.	E. McManus, Northam.	T. A. Hardie & Son, Narrogin.	D. Bradford, Narrogin.	L. P. James, Cranbrook.	W. Chester, Mt. Barker.	R. McDougall, Narrogin.
Fodder conserved per head of Dairy Cows	50	50	50	50	50	50	37	43
Use of Phosphatic Licks ...	25	25	20	25	20	...	20	10
Silage—(100 points)—								
Material and Mixture ...	20	10	9	8	7	...	9	...
Type and Palatability ...	30	15	14	11	11	...	11	...
Percentage Waste	30	15	14	8	10	...	8	...
Time of Cutting	10	5	5	5	3	...	5	...
Workmanship, Finish, etc....	10	5	5	3	3	...	2	...
Fodder Crops—(100 points)—								
Yield based on Food Value (per acre)	50	20	15	15	15	40	20	34
Freedom from Disease ...	10	5	5	5	5	10	5	9
Freedom from Weeds ...	15	6	6	6	6	13	7	13
Cultivation and Manuring ...	15	7	6	5	5	13	6	13
Evenness of Growth ...	10	4	3	4	4	9	3	6
Total ...	175	167	152	145	139	135	133	128

Illustration 5.

Maize and Cow Peas grown by S. F. Russell, Serpentine.

TABLE 7.—POINTS GAINED BY COMPETITORS.

Zone 7.—Centre Denmark Agricultural Society.

Judge: H. G. ELLIOTT, Agricultural Adviser, Dairy Branch.

——	Max. Points.	Bayley Bros., Denmark.	J. Daly. Bornholm.	L. Hargrave.	F. C. Smith.	P. Berridge.	W. Nancarrow.
1. FARM MANAGEMENT—(75 points).							
(a) Lay-out and Convenience	30	27	20	21	22	20	18
(b) General Management, including Sanitation, etc.	25	23	19	18	19	15	15
(c) Book-keeping and Records	20	18	8	10	12	11	5
2. DAIRY HERD—(100 points.)							
(a) Breeding—System of	25	20	18	15	16	17	15
(b) Dairy—Type and Condition	30	24	23	22	23	21	22
(c) Bull (give particulars of breeding and production ancestry)	25	24	19	15	..	24	24
(d) Pigs—Breed, condition, etc.	20	18	19	14	15	15	12
3. PASTURE AND FODDER CROPS—(100 points).							
(a) Pasture	60	53	44	45	48	48	43
(b) Fodder Crops	40	31	38	30	33	30	27
4. FODDER CONSERVATION—(150 points.)							
(a) Silage:—							
Succulency	20	18	...	17	19	18	17
Mixture	20	18	63	18	17	17	18
Type of Silage	10	8	...	8	8	9	8
Percentage Waste	20	18	..	18	18	17	17
(b) Hay:—							
Mixture	20	19	19	19	19	19	18
Condition	20	17	17	17	18	18	17
(c) Amount of Fodder conserved per head	20	20	20	20	20	20	19
(d) General Lay-out for convenience in feeding	20	14	10	10	16	10	11
5. UTILISATION OF SEPARATED MILK FOR PIGS, POULTRY, ETC.—(25 points.)							
(a) Pigs	20 5	20	19	15	17	16	14
6. BUTTER FAT PRODUCTION—(50 points.)	50	35	34	50	37	30	21
Total	500	425	389	382	377	375	341

LESSONS FROM THE COMPETITION.

During the two years that the competition has been conducted, no less than 127 farms have been carefully judged, practically every phase of operations being scrutinised by officers of the Dairy Branch, and a great deal of reliable and valuable information has been gained in this manner.

1.—FARM MANAGEMENT.

As was noted last year, the lay-out of many farms in the competition indicate that development has not proceeded along any well conceived plan, but fences, drains, etc., have been erected or dug as the needs of the moment dictated. Especially is this the case in the older established farms.

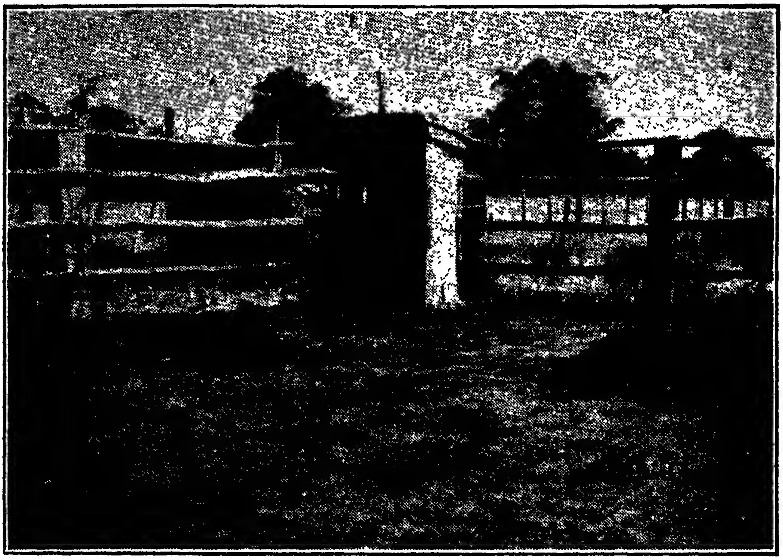
It is encouraging to note, however, that as the necessity for smaller paddocks is being realised, there is a very definite swing to good farm planning, generally the paddocks being offset on either side of a central race.

A distinct improvement in the records kept by farmers has been noticed, where the same farmers entered the competition for the two years. A dairy farm should be essentially a mixed farm, embracing the production of butter fat, pigs and poultry, with perhaps cropping as a useful *but limited* sideline depending on the bent of the particular owner.

There is a tendency to regard the only income from a dairy farm as that from butter fat, while in fact, it should be only the main item, in a varied source of revenue.

It is most important therefore that records kept should be of such a nature as will show the expenditure and receipts in each department. A very marked interest was evinced in grade herd recording, and the farms where daily or weekly records of milk production are available is a distinct increase on those for last year.

Illustration 6.



Good management on Mr. S. F. Russell's Farm. Manure is removed daily and carted to fields weekly. Phosphatic lick always available in sheltered bin.

2.—DAIRY HERD.

The summer just completed, 1932-33, has been an unusually dry one, yet stock throughout the dairy districts have been maintained generally in good condition, particularly so on the farms of competitors. This has been due almost entirely to more adequate conservation of fodder.

Competitors in all districts have now developed herds approaching strong breed characteristics of the particular type to which they have been grading up by the *continued* use of pure bred bulls of the *same breed.* This in great part may be ascribed to the departmental policy of supplying definite breeds of bulls to certain districts, known popularly as the "Zone System."

The 80 bulls in use in the herds of competitors may be classified as follows:—

TABLE 8. HERD BULLS IN USE.

——	Pure Bred ex tested Dams.	Pure Bred.	Grade.	Total.	Percentage.
Jersey	35	17	1	53	66
Guernsey	11	2	1	14	18
Milking Shorthorn	2	7	.	9	11
Ayrshire	3	1	..	4	5

For the season 1931-32 of the bulls owned by competitors 91 per cent. were pure bred, while for this season the percentage is 98 per cent.

This is a result which should afford serious room for thought to those dairy farmers who do not own pure bred bulls or ex-tested dams, particularly in view of the good average yields of the cows in the herds entered in the competition. (See below.)

BUTTER FAT PRODUCTION.

A number of herds entered for the competition gave remarkably high average productions, and these yields err on the side of conservatism, as yields were in every instance calculated from the actual butter factory receipts.

In each zone several herds are of outstanding merit, the higher yields being due not to greater quality of the cows, but to careful and efficient management and feeding. The following individual herd averages are a credit to the owners concerned, and are all over 250 lbs. butter fat per cow.

	No. of cows.	Average Production. lbs. fat.
H. Eddy, Margaret River	16	310
P. Rose, Burekup	64	281
S. Smith, Margaret River	12	275
A. Miller, Forest Grove	23	258
H. C. Barnsby, Pemberton	18	257
E. C. Melville, Wonnerup	23	251

The average production of the cows in all zones is shown in the following table:—

TABLE 9.—AVERAGE PRODUCTION PER COW IN EACH ZONE—TOGETHER WITH THE AVERAGE OF TOP HERD.

Zone.	No. of Cows.	Average Cows in Herd.	Average Butter Fat per Cow.
1. Harvey	190	31·7	165·6
S. F. Russell	..	30·0	210·1
2. Bunbury	380	42·2	229·2
P. Rose	...	64 0	280·8
3. Margaret River	452	29·6	188·6
H. Eddy	...	16·0	310·4
4. Bridgetown	186	23·3	205·3
E. E. Kendall	...	27·0	246·4
5. Manjimup	209	23·2	198·5
H. C. Barnsby	...	18·0	257·2
7. Denmark	114	19·0	221·5
Bayley Bros.	...	26·0	243·5
Average all zones	1,531	25·5	201·5

In view of the fact that the average production of all cows in the competition numbering 1,531 was 201. 5lbs. of butter fat, it is reasonable to assume that the average production of cows in the dairy belt is exceedingly higher than the State average given in Statistics, approximately 120 lbs. The results obtained in the 1931-32 competition corroborate this assumption, and these results taken together with other information available, points to an average production in the South-West of approximately 180 lbs. per cow.

It is significant in Table 9 that the lowest average productions are found in Zone 1, in which all competitors except one were suppliers of whole milk to the metropolis. This necessitates keeping production at a constant figure, and generally

requires a larger number of cows in milk during the summer months than during the flush of the year. This, of course, is an added expense to the whole milk producer.

Illustration 7.

Mr. P. Rose's Herd of Pedigreed Jersey Cows, "Yeeralla," Burekup.
Average production of 64 cows: 281 lbs. butter fat.

BUTTER FAT PER ACRE.

The average production of butter fat per acre, which has been remarkably consistent during the two competitions, provides a valuable index to the revenue-producing capacity of the average farm, and also is a reliable guide to the most economical size for a dairy farm.

TABLE 10.—AVERAGE PRODUCTION OF BUTTER FAT PER ACRE IN EACH ZONE COMPARED WITH THAT OF LEADING COMPETITORS.

Zone.	Acres devoted to Dairying per Farm.	Average No. of Cows per herd.	Butter Fat per Acre.	
			1932-33.	1931-32.
1. Harvey Average	150·7	31·7	34·8	53·4
S. F. Russell	115	30·0	55·0	...
2. Bunbury Average	207·5	42·2	46·6	50·4
H. Noon	90	21	48·3	...
3. Margaret River Average	88·8	20·6	43·6	37·9
C. H. Ironmonger	110	23	49·0	...
4. Bridgetown Average	117·4	23·3	40·7	35·1
A. Hayward	80·0	19·0	59·7	...
5. Pemberton Average	118·1	23·2	38·8	35·5
H. C. Barnsby	82·0	18·0	56·5	...
7. Denmark Average	85·1	19·0	49·4	45·4
Barley Bros.	115	26·0	55·0	...
Average all zones	120·6	25·5	42·6	43·0
Average 6 leading Farms	98·7	23·0	54·0	49·0

It will be seen from this table that, while there have been fluctuations in the zones in connection with the butter fat return per acre, the average figure for all farms over the two years of the competition are remarkably close, approximately 43 lbs. of butter fat per acre, while the average area on each farm actually being utilised in connection with the dairying operations is approximately 120 acres.

The six leading farms, however, returned 54 lbs. of butter fat per acre, or 11 lbs. more than the average, the average area of these farms being 98.7 acres.

In order to arrive at some estimate as to the economic size of a dairy farm under average conditions in the Dairy Belt, it is necessary to have some information regarding the carrying capacity of the land. Table 11 sets out the acres of land utilised per milking cow in each zone, both for 1931-32 and 1932-33.

TABLE 11.—ACRES UTILISED PER MILKING COW.

Zone.	Average No. of Cows in Herd.		Acres devoted to Dairying.		Acres per Cow.	
	1932-33.	1931-32.	1932-33.	1931-32.	1932-33.	1931-32.
1. Harvey	31·7	31·7	150·7	138·9	4·8	4·38
2. Bunbury	42·2	43·5	207·5	247·7	4·6	5·10
3. Margaret River ...	20·6	19	88 8	81·5	4·3	4·28
4. Bridgetown	23·3	17 6	117·4	96 1	4 4	5·47
5. Manjimup	23·2	17·1	118·1	92·4	5·1	5·43
7. Denmark	19	13·7	85·1	57·4	4 5	4·19
Average all zones ...	25·5	23·7	120 6	119·0	4·7	4·91

Table 11 indicates that while on the average the individual herds have increased, this increase has been accomplished by bringing a greater area into production, and not through more intensive cow carrying capacity per acre.

Remembering that competitors represent the leading dairy farmers in the State, and, in a number of instances, the most successful financially, this fact is worth special attention.

The two years' results indicate that on the average unirrigated farm approximately five acres is required per cow, which includes also yearlings, calves, and other stock which would be associated with a milking cow—this is usually referred to as a cow unit.

If, therefore, it is considered that a herd of 20 cows is necessary to maintain a family in comfort and meet all liabilities, then not less than 100 acres would be required, and, under average conditions, a 100-acre unirrigated farm would be fully stocked with a herd of 20 milking cows.

PIGS.

The majority of competitors were paying attention to the breeding of pigs, though with the low prices that have ruled during the last 12 months, the number of breeding sows have been reduced to a minimum. 83 per cent. of farmers owned one or more breeding sows.

Table 12 shows that the Berkshire and Tamworth breeds and their crosses are the pigs in most favour.

TABLE 12.—BREEDS OF PIGS OWNED BY COMPETITORS.

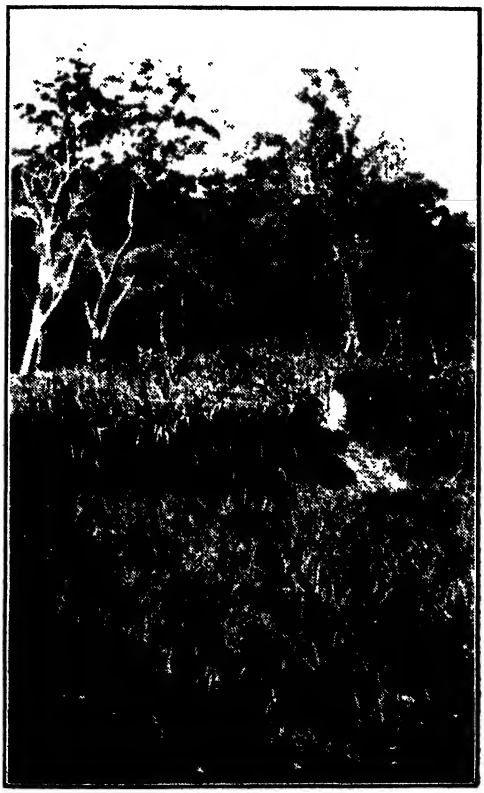
Number of Sows.	Per cent.	Breed of Sows.
70	49	Berkshire
55	38	Tamworth-Berkshire
6	4	Middle White
4	3	Middle White-Berkshire
2	1	Large White
7	5	Other Breeds
Total ... 144	100	

TABLE 13.—COMPARISON OF NUMBER SOWS TO COWS.

Zone.	No. of Cows.	No. of Sows.	No. of Sows to Cows.
1. Harvey	190	13	1 : 14·6
2. Bunbury	380	38	1 : 10·0
3. Margaret River	452	47	1 : 9·6
4. Bridgetown	186	18	1 : 10·3
5. Manjimup	209	18	1 : 11·6
7. Denmark	114	10	1 : 11·4
All Zones—			
1932 33	1 531	144	1 : 10 7
1931 32	950	141	1 : 6·7

The very serious falling off in the number of sows in comparison with cows will be noticed, the number being reduced from 1 sow to 6.7 cows to as low as 1 sow to 10.7 cows. This is in great part due to the high cost of marketing of bacon or pork pigs from such areas as Busselton southwards and Manjimup southwards, the marketing charges being a large percentage of the carcase value at the low prices ruling.

Illustration 8.



A prolific crop of Millet.
Mr. S. Gray, Manjimup, 1933.

Although the prices ruling for pigs have been low, by avoiding the purchase of concentrates as far as possible, and by the growing of such fodders as maize,

peas, beans, barley, etc., a number of competitors demonstrated that pigs can still be reared at a profit. Mr. H. C. Barnsby showed particularly high returns, averaging £3 per cow nett profit from pigs.

The number of pigs reared must be dependent in part on the number of calves reared. Interesting information on this point was collected by Mr. M. Cullity, who judges Zones 2, 4, and 5, and is shown in Table 14.

TABLE 14.—CALVES REARED AND PIGS FATTENED PER COW.

Zone.	Cows.	Calves reared.	Pigs fattened.	Total calves and Pigs.	Pigs and calves fed per Cow.
2. Bunbury	380	272	631	903	2·4
H. Noon	21	5	65	70	3·4
4. Bridgetown	186	99	195	294	1·6
F. O. Nelson	24	17	55	72	3·0
5. Manjimup	209	85	272	357	1·7
H. C. Barnsby ...	18	13	69	82	4·5

Table 14 shows that in the newer areas the carrying capacity per cow of calves reared or pigs fattened can be considerably increased. Mr. H. C. Barnsby is to be specially complimented on his efficient utilisation of skim milk. Mr. Noon, either by design or by mischance, was unable to rear a full quota of calves, but made up for this by utilising the skim milk available for rearing and fattening pigs. The low average figure for Zones 4 and 5, in comparison with the average for Zone 2, indicates that efficient utilisation of skim milk is a factor in the farm profits that needs careful watching.

Illustration 9.

Elephant Grass grown by S. F. Russell, Serpentine.
A promising summer fodder.

4. *Pasture and Fodder Crops.*

While on almost every farm efforts are being made in the direction of developing permanent pasture, with a view primarily of reducing labour, it must be admitted that, except on favoured spots or with irrigation, little advance has yet been made, other than on experimental areas.

The necessity for the provision of summer fodder crops or of silage to be fed during the summer months is as great as ever, and may be considered essential.

The area of each farm devoted to summer cropping is still very small, and the results in many cases are disappointing.

Heavy applications of expensive mixed fertilisers often are applied with poor results. Maize and fodder crop trials have shown that heavy applications of fertilisers are wasted unless the ground has been thoroughly cultivated. This latter operation has been the limiting factor, and imperfect aeration of the soil.

Land that is waterlogged during winter is unsuitable for the growing of summer crops. Better results are obtained on well cultivated land at a higher elevation, the thorough cultivation conserving the moisture necessary for the summer crops. This is demonstrated by the results obtained in Zone 6, along the Great Southern Railway, with the growing of Millet and Sudan Grass.

With good cultivation 3 cwts. of superphosphate and ammonia No. 2 should be a sufficient and economic dressing for summer fodder crops.

TABLE 15.—ACREAGE OF GREEN FODDER PER COW.

Zone.	Summer Fodders.	Acres sown per Cow.
	acres.	
1. Harvey	36·5	0·19
2. Bunbury	15·75	0·04
3. Margaret River	66·5	0·14
4. Bridgetown	5·0	0 02
5. Manjimup	28·75	0·14
7. Denmark	43·5	0·38
Total	196·0	0·127
6. Narrogin	165·0	1·56

Zones 1—5 and 7 enjoy 30–60 inches of rainfall; zone 6 only receives 17–25 inches.

Table 15 shows that, except in the comparatively dry area in Zone 6, the acreage of summer fodders sown per cow is negligible. It may be reasoned that, in the dairying districts of the wetter South-West, silage is made in large quantities, and can take the place of summer crops which are expensive in labour.

This, however, is not borne out by the facts, as is shown in Table 16, which sets out the total tonnage of conserved fodder per cow, which, although an increase over last year, is still short of what is considered desirable.

TABLE 16.—TOTAL CONSERVED FODDER PER COW.

——	Cows.	Hay.	Silage.	Reserve per Cow. Hay.	Reserve per Cow. Silage.	Reserve per Cow calculated as Hay.
		tons.	tons.			
Zone 1 Average	190	175	192	0·92	1·00	1·25
J. H. W. Masters	30	50	70	1·66	2·33	2·43
Zone 2	380	388	192	1·02	0·50	1·19
J. Hearman	15	32	36	2·13	2·40	3·93
Zone 3	452	623	519	1·38	1·14	1·75
C. H. Ironmonger	23	45	80	1·96	3·48	3·15
Zone 4	186	179	152	0·94	0·81	1·25
H. E. Kendal	27	60	20	2·22	0·74	2·47
Zone 5	209	328	479	1·58	2·29	2·37
G. F. Combs	15	40	120	2·66	8·00	5·33
Zone 7	114	241	250	2·11	2·20	2·66
F. H. Smith	12	51	40	4·25	3·33	5·36
Average all Zones, 1932–33 ...	1,531	1,854	1,784	1·21	1·16	1·60
1931–32	1,502	1,605	931	1·06	0·71	1·38

1 ton hay = 3 tons of silage.

Table 17 shows that competitors have paid more attention to the conservation of fodder since the first competition in 1931-32, but the average conserved per cow, *i.e.*, 1.6 tons, is still a long way below the objective set two years ago, namely, 2½ tons per cow.

It is instructive to compare the fodder conserved in the drier Zone 6 (centre at Narrogin) with that in the more favoured districts of the South-West.

TABLE 17.—FODDER CONSERVED PER COW IN WET DISTRICTS COMPARED WITH THAT IN DRY AREAS.

Zones	Hay.	Silage.	Total Reserve per Cow calculated as Hay.
	tons	tons.	tons.
Average - All Zones in Wet Districts	1·21	1·16	1·6
Average - Zone 6 (Narrogin)	2·9	3·3	4·0

Table 17 shows that farmers in the drier areas fully realise the necessity for fodder conservation, thereby setting a valuable lesson to all dairy farmers in the State. Such conservation also explains how it is that herds in these areas can put up the production records they do. The records of herds owned by Messrs. W. G. Burges, "Tipperary," York, S. P. Herbert, Nungarin, A. W. Padbury, Koojan, T. H. Wilding, Mokine, and Miss L. Hancock, "Juadine," will compare favourably with those not only in this State but in any State in the Commonwealth.

In view of the improvement in fodder conservation, it is interesting to examine the position in each Zone, and also the type of fodder in favour by dairymen, which is clearly set out in Table 18.

TABLE 18.—COMPARISON OF FODDER CONSERVED PER COW IN 1931-32 AND 1932-33.

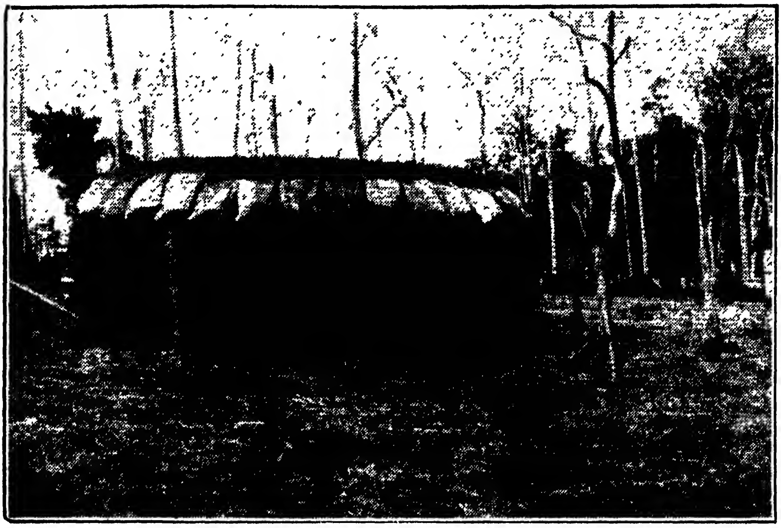
Zones.	Reserve per Cow. Hay.	Reserve per Cow. Silage	Total Reserve calculated as Hay.
	tons	tons.	tons.
1. Harvey—1931-32	0·76	0·24	0·84
1932-33	0·92	1·00	1·25
2. Bunbury—1931-32	0·40	0·40	0·53
1932-33	1·02	0·50	1·19
3. Margaret River—1931-32	1·12	0·90	1·42
1932-33	1·38	1·14	1·75
4. Bridgetown—1931-32	1·23	0·75	1·48
1932-33	0·94	0·81	1·25
5. Manjimup—1931-32	1·53	0·71	1·76
1932-33	1·58	2·29	2·37
7. Denmark—1931-32	1·62	0·71	1·85
1932-33	2·11	2·20	2·66
Average—1931-32	1·06	0·71	1·33
1932-33	1·21	1·16	1·60

Table 18 shows that in all Zones, except Zone 4, there was a considerable increase in total fodder conserved.

Farmers in Zone 7 (Denmark) are to be congratulated on the improvement shown this year over the already high conservation last season, and on this being the first Zone in the South-West to average over 2½ tons per cow.

Silage generally seems to be the fodder showing the greatest increase. In all Zones but one a considerable increase in silage is noted. In Zone 2 (Bunbury), however, the increased fodder is conserved as hay, while the total conservation in this Zone is the least. Several of the larger farmers in this Zone, however, own areas of excellent summer pasture, which accounts for high average yields, although fodder conservation was low.

Illustration 10.



A well-built 40-ton silage stack. Dr. A. G. Abbott, Eastbrook. Bags of earth held in position by wire threaded through end; centre filled with earth.

The average increase in hay per cow .15 tons, or 14 per cent., while the increase of silage per cow is .45 tons, or 63 per cent.

From the point of view of the division and spread of labour on the farm, silage is undoubtedly the fodder along which increased production can be developed. One ton of hay per cow is probably the most economical quantity to conserve, the deficiency to reach 2½ tons being made up by conserving 2 to 3 tons of silage per cow, and by increasing the acreage sown to fodder crops.

SUMMARY.

1. The division of farms so as to allow of rotational grazing is more frequently noticed, particularly on farms of small area.

2. More detailed records were available to the judges this year, specially as regards the differentiation of the revenue from the different farm activities.

3. The average production of the 1,531 cows in the competition was 201 lbs. of butter fat; there is reason to believe that the average cow in the South-West produces 180 lbs. approximately of butter fat per annum.

4. A policy of "grading-up" of herds by the use of pure bred bulls with production backing is being generally practised by competitors. Ninety-eight per cent. of the bulls owned are pure-bred.

5. The percentage of bulls in use according to breed is as follows:—

Jersey	66 per cent.
Guernsey	18 per cent.
Milking Shorthorn	11 per cent.
Ayrshire	5 per cent.
	100 per cent.

6. Interest in pig-raising has decreased, the number of cows per brood sow being now 10.7 as against 6.7 for 1931-32.

7. The predominating breeds are Berkshire and Tamworth and crosses of these two. Eighty-seven per cent. of the brood sows were of these two breeds.

8. Considerable variation is found from farm to farm in the skill with which skim milk is utilised for feeding to stock. The number of pigs plus calves reared per cow varied from 4.5 to as low as 1.6.

Illustration 11.

H. C. Barnsby, Clovelly Farm, Pemberton.
Feeding Ensilage.

9. On the average dry farm the production of butter fat per acre is 43 lbs., a figure constant for the two years of the competition, and this is probably a fair average figure for most farms. The six leading farmers, however, produced 54 lbs.

per acre, the highest production being 78.4 lbs. per acre on the farm of Mr. L. L. Hargraves, Denmark.

10. The average herd in the competition numbered 25 cows, the average farm containing 121 acres.

11. In dry areas the necessity for fodder conservation is more generally realised, the conservation per cow being 4 tons, as against 1.6 tons in areas of heavier rainfall.

12. A greater production of silage is shown to be the method by which fodder reserves should be increased.

13. There is an urgent necessity for more attention to the growing of summer fodder crops. The average area sown per cow is only 1/10 acre in wet districts, while in dry districts found in Zone 6, the area planted was 1½ acres per cow. At least half an acre per cow should be the aim.

14. The use of PHOSPHATIC LICKS is essential during the summer months.

THE SUPPORT OF FRUIT TREES IN HEAVY CROPPING SEASONS.

A. FLINTOFF, Horticultural Inspector.

At no period, for many years past, has the operation of supporting fruit-trees under normal to heavy crops appealed so strongly as during the present season.

Probably many orchardists with modernised ideas scorn the idea of introducing artificial means of support, claiming that the proper training of the tree obviates such measures. Nevertheless there are numbers of growers of another school of thought, and even should their ideas not exactly harmonise with the actual conditions of the fruit trees under their control, are believers in assisting any fruit tree to bear up under the weight of fruit due, in a measure, to modern achievement. Quite irrespective of what they believe, some orchardists are compelled, rather than risk serious and permanent injury to their trees, to assist them by artificial means to bear the heavy crop which nature, aided by their skill, has produced.

An extraordinary burst of heat visited the State early in February of this year (1933), causing much damage to fruit, particularly the apple crop. The harm done was accentuated by, in the case of heavily laden limbs, the sun's rays reaching many fruits that were, earlier, protected by leaves. The limbs referred to bent under the increasing weight of fruit, thereby exposing new surfaces to the heat of the sun. Particularly was this the case with varieties not normally strong limbed as Jonathan and Cleopatra. Stronger growing trees, such as Dunn's Favourite and Rokewood, have the advantage over the first-mentioned varieties in that the angle of deflection is not so pronounced in the limbs under heavy crops, the fruit being, thereby, more or less protected.

In arriving at a solution of the most economical system of support, combined of course with efficiency, orchardists the world over have used their inventive faculty to overcome the natural tendency of fruit-tree limbs bending to such an extent as to hamper work and be in danger of breaking or exposing the fruit to the abnormal heat of the sun. As a consequence we find many styles of tree

supports in use, the most common, perhaps, being the use of forked props. Other methods used include cross wiring, girdling, centre poles plus wire or rope ties. The latter is termed the maypole system, because of the appearance of the wires or ropes after attachment to the top of pole and to points on the limbs at a lower plane. Let us consider the relative merits of some of the systems in vogue.

Propping with forked sticks.—This involves the labour of procuring odd length poles to suit individual requirements. In many populated centres, to obtain sufficient suitable props from time to time is a serious problem, for it is admitted that light, sappy poles do not last for many seasons and need renewal. Should a good supply be available the work of distributing and placing is considerable.

The advantages may be summed up as follows:—Cheapness of material where such is abundant and labour cheap. The saving of trees and fruit by keeping limbs in a normal position.

Disadvantages.—Cost of material where long distances are necessary for procuring props; inconvenience in cultivating, carting, etc.; extra work entailed in removing and stacking props for another season; renewal of props at more or less frequent intervals; damage to trees when, as often happens, props fall during windy periods.

Cross ties.—This is a system of tying wire or rope from one limb to another, through and across the tree. A central ring is often used, with the ties radiating to the limbs, as this effects a saving in wire.

The advantages of this system include cheapness of material, reasonable permanency, and ease of fixing.

Disadvantages are, cutting into the bark at the point of contact unless suitable "pads" are used to counteract the heavy pull occasioned owing to the opposing limbs with their weight of fruit exercising an extra strain at each terminal of the wire. A frequent fault of this method is due to nature failing to provide a balanced tree, *i.e.*, equal straight limbs on all sides. It will be conceded that a fair percentage of unbalanced trees exist in most orchards. In consequence one side of the tree is stronger in growth than the other and, as the extra weight of the strong limbs and their fruits weigh down, the weaker branches give way, the result being either limbs broken or so far pulled across to the centre that the last stage of the tree is worse than the first. A further difficulty occurs when spraying or pruning, the permanent wires interfering with the most economic working.

Girdling.—In this operation a rope or wire encircles the tree at a point up the limbs considered suitable to the occasion. In large trees two, and sometimes three, girdles are used.

Advantages.—Cheapness of material, ease of application, permanency, etc. Sub-leaders may be tied up at any point to the wire.

Disadvantages.—Cutting into the bark at point of contact. This is not so apparent where rope is used, although instances are recorded showing that chafing of binder twine has actually destroyed the bark where twine chafed. As in the case of crossties, inconvenience when spraying or pruning. Danger of damage to the tree and fruit if the strong and heavily laden portion drags the weak side over. Unsatisfactory adjustment of the girdle in low-spreading trees, the weight of limbs, as the fruit develops, being very liable to turn the tree inside out.

Maypole Style.—Of reasonably recent adoption in this State, this system may claim to embody the best known principles of fruit tree protection, that is, in relation to saving from breakages and sun scald. This method consists of a stout pole

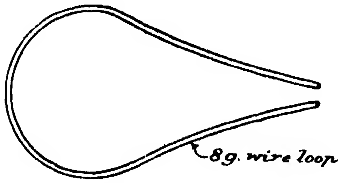


Fig 1.

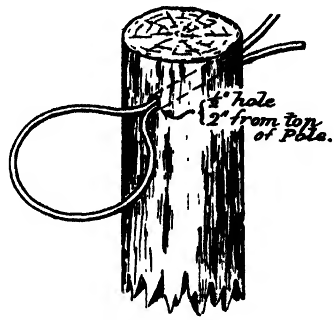


Fig 2.

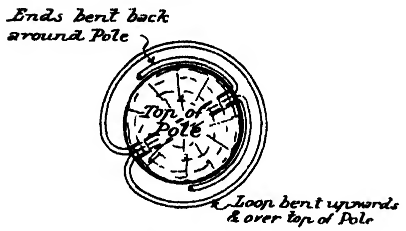


Fig 3.

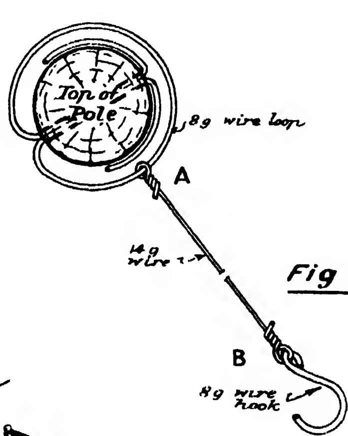
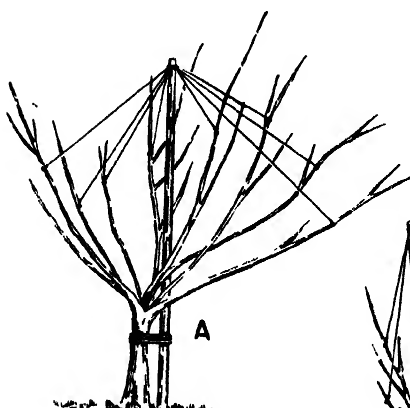


Fig 4.



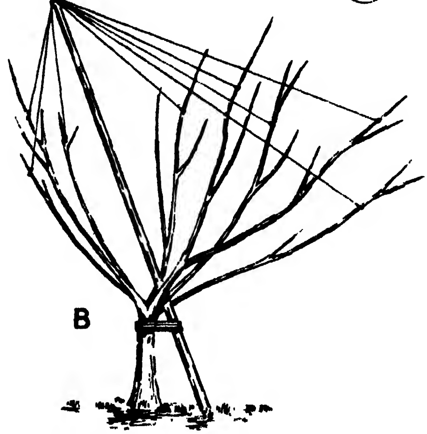


Fig 5.

(3in. to 4in. diameter at top) and wire equipment; the wires are fastened to the top of pole, to be brought then, at the other terminals, to suitable points in the limb system.

Disadvantages.—As with every system there are pros and cons, we may criticise the higher initial cost of the style; the eyesore, if it may be so termed, of a

stout pole, say 10ft. in height, as a permanent fixture; the complaint that the pole may become an agent for harbouring white ants, red mite, etc.

Advantages.—Permanency combined with efficiency; no obstruction to orchard traffic; the unbalanced tree having no danger of collapsing, as the pole takes any unequal strain; no inconvenience when spraying or pruning, as usually when half the crop has been gathered the limbs are released from the wire hooks, the wires hanging down the centre pole till again required.

Although observation leads me to favour the last-mentioned system, it would be unwise to condemn any style that may be proved by circumstances to be serviceable and economical. I would, however, advise those growers contemplating any systematic treatment in protection of their fruit-trees to consider the initial cost commensurate with efficiency, the average annual cost covering a term of, say, ten years, assuming that period to be the life of the costliest system. If the first outlay is high, it is reasonable to expect that recurring annual cost will be low.

Description of Maypole Style.—Material required: Pole 8ft. to 10ft. in length, according to height of tree; No. 8G steel fencing wire (galvanised); No. 14G mild steel galvanised wire. Although redgum sapling are condemned on account of liability to decay, I find that this timber is found anywhere in fruit-growing areas. The timber is of no commercial value, and easily procurable; is straight of growth, and, if barked at once and dried, makes good poles for above-mentioned purpose. Certainly they may not last as long as jarrah, but the latter is not always easy to procure. I have seen redgum poles standing for over ten years when used in fowl runs, etc. The fact that decay may set in at the ground level does not greatly concern us, as they are only a few inches in the ground. Any waste timber, such as 3in. x 2in. scantling, may be used, or a free-splitting jarrah would be useful.

According to the timber so the size may be judged. Ordinarily a jarrah pole 3in. in diameter at top, or redgum 4 inches, would be found sufficiently strong and lasting.

Having secured the pole, the next operation consists in forming a ring or loop of wire at the top. Several methods have been tried out, and I find a simple one is to bore a hole (½-inch) 2 inches from the top; take a piece of wire about 2ft. long, bend into a wide loop as Fig. 1, pass the two ends through the hole till they project about 3in. or 4in. (Fig. 2). Then bend the ends round the pole. Then bend the loop upwards and over the end of pole, forming a rough ring around the pole (Fig. 3). Stapling or nailing of a ring of wire is not entirely satisfactory owing to the frequency of splitting where staple penetrates. I have found the method shown cheap and satisfactory.

Now take a length of the smaller No. 14 gauge galvanised wire and attach one end to the ring as at A, Fig. 4; at the other extremity attach a No. 8 wire hook, as at B, Fig. 4. This, obviously, is to hold the limb. The hook remains open and, being of stout steel wire, will not spread with reasonable use. The open hook is used so that, at an instant, it may be detached from the limb and either moved to a fresh position or left hanging until wanted. If cutting of bark is feared, a small pad of bagging, etc., can be placed between the limb and the hook.

The 14 or 16 gauge mild steel wire is recommended to save expense, as there is approximately twice the length in a cwt. of the thinner wire as is found in No. 8 gauge. There is no objection to using No. 8 right through, which would obviate making separate hooks. The advantage of an open hook is found on occasions when, for instance, the crop is thinned during harvest, and the limbs may be quickly released and pulled down to facilitate picking. Pruning is also made easier

when limbs are released. The same may be said in regard to spraying. The wires may be fixed to the top ring before erecting the pole, the loose ends being temporarily fastened to the pole.

To avoid any danger from the use of redgum poles the lower ends may be dipped in wood-preserving oil or hot tar.

Difficulty is sometimes encountered in propping a very much one-sided tree, and the pole has been firmly tied to the tree trunk to prevent the heavily laden limbs from pulling the pole over, as at A, Fig. 5. The weakness of this adjustment lies in the fact that a heavy strain is put on the pole at the point A, which may break if weakened with age. Although all poles require tying to the trunk until the weight is more or less evenly distributed, the correct method of placing them on unbalanced trees is shown at B, Fig. 5. Admittedly this is not picturesque, but will be found to take the strain with little fear of breaking at the point referred to.

EXPORT AND BREEDING.

A. C. JENYNS, Poultry Adviser.

The egg export season is now at hand, and the results of last season's breeding will be tested as to its improvement or otherwise by the egg producing qualities of the young stock. With regard to egg size, the basis of quality or grade should be the 15 lb. export pack, viz., eggs from 1⅞ to 2⅛ ounces, giving an *average of 2 ounces* in weight.

At this stage the farmer should be able, by noting the quantity of eggs fit for the 15 lb. (and larger) packs, to determine whether his last year's mating had brought an improved output and a better egg size.

It must be remembered that, though there is a lower weight pack exported, this is no reason for thinking that getting rid of the small eggs overseas is any excuse for laxity in breeding for a 2 oz. standard. It is well to look ahead to the glut which follows the export season. It is then the producer of small eggs becomes a menace not to himself but to the *Industry*. One low-priced grade of egg on the market in large quantities is going to have a lowering influence on all the grades exposed for sale. Another point to keep under notice is that, as production increases, cool store requirements decrease, thereby closing that avenue of escape from the glut. The greater the production, the more early winter eggs there are available, and there is no use putting eggs in cool store to be detrimental to the early winter new laids.

These glut times are when the careless breeder, the man who breeds from any old stock that comes to hand, or because it won a prize at a show, with no idea of the stock it was bred from—whether from a good egg laying strain, or just bred for show purposes alone.

Fine feathers do not lay eggs. It is the breeding that gives results. Appearance is necessary, but not nearly so essential as a bloodline of egg production and *egg size*.

One of the main faults in breeding (and it is perhaps the most vital point in mating), is the frequent practice of incubating eggs from birds picked out of the flock at the *last moment*, mated and called a breeding pen. This is the surest method of producing a flock of lowered vitality, subject to each and every disease which may appear.

Breeders are the most important stock on the farm. On them depends the future, whether it be success or failure. They should be treated as breeders, not only when in the breeding pen, but all the time. In the moulting season these birds should have particular care, not forced through into lay, but carefully fed and handled. The moult comes just prior to breeding time, and this period should be spent in building up the stock, seeing it is well and properly fed, housed, and treated in every way as is the due of the producer of the farm stock for the future.

Birds in the moult kept in good condition (a little over fat, if anything) are going to mean pounds in pocket later. A slight increase in the bran and green feed will correct the fat condition of the stock, and they come into lay in good condition instead of having to be fed up to egg production after a hard lean period in the moult.

It must be remembered also that a lot of eggs do not mean a lot of chickens, so in feeding breeders the feeding should be for chickens (or hatchability); a few less eggs, but every egg a chicken, should be the motto.

Three or four mashes (mornings) weekly and the rest of the food grain, with an abundance of green feed, will give a wonderful return in *hatchability* and strength of germ.

This was confirmed by experiments carried out for five months during last season when over 20,000 eggs were incubated from stock fed on different rations. A maximum of chicks from the minimum of eggs was arrived at with the result as 88 per cent. hatchability for the hard feeding (as above) against 71 per cent. on soft feed.

This care and attention to breeding stock is so vital that it seems hard to understand why so little attention is paid to it, especially when faced with the fact that this season's breeders have to produce the stock from which the farm is to be carried on and restocked in two years' time. The factor of selection is in many cases well and correctly carried out, but only just at the last moment before mating.

A line of breeders is as distinct from the ordinary *laying* flock as the *stud* of any sheep or cattle breeder, for on this line depends the future of the farm. It is not just eggs which are required for profit, but eggs of size and quality.

FIELD EXPERIMENTS WITH WHEAT, 1932.

MERREDIN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.

J. H. LANGFIELD, Farm Manager.

In addition to the experiments published in the March issue of this Journal, the following experiments were conducted at the Merredin Experiment Farm during 1932:—

Fallow v. Non-Fallow.
Time of Ploughing.
Mulching Experiment.

The total rainfall for the year was 1,307 points, of which 1,113 points fell during the growing period (May to October). The following table shows the monthly rainfall for the year, together with the average over a period of 21 years.

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period							Nov	Dec.	Total for year
					May.	June	July.	Aug	Sep	Oct	Total			
1932	51	11	59	42	160	69	231	283	56	314	1,113	...	31	1,307
Avg. 21 yrs	52	54	116	82	136	185	190	152	90	85	838	43	52	1,237

Very little rain fell before 25th May, and consequently it was not possible to work the fallow wet before seeding and control weed growth. June was a comparatively dry month, only 69 points being recorded, but the registrations for both July and August were above the average. During September the rainfalls were scanty, only 56 points being recorded. The October rainfalls were unusually high, 314 points being recorded against the average for this month of 85 points.

The October rains, by reason of their lateness, lost much of their value except for the late plantings. As a result of these late rains, however, an excellent sample of plump grain was obtained.

The land on which these experiments were conducted originally carried salmon gum and gimlet timber, the soil being typical of such country. For some years the three-year rotation, namely, fallow, crops (chiefly wheat) and pasture has been practised.

During 1931 the land had been ploughed with a heavy disc plough to suit the requirements of the respective experiments. It was worked with a disc cultivating plough during September and again just before seeding.

Fallow v. Non-Fallow Experiment.

The object of this experiment, which has been conducted since 1925, is to demonstrate the advantage of fallowing.

Two plots, each one quarter of an acre in area, were set apart for the experiment, one of which was ploughed four inches deep in June, 1931, the other plot (non-fallow) being ploughed after rain late in May and disc cultivated immediately prior to seeding.

The results obtained are as follow:—

FALLOW v. NON FALLOW EXPERIMENT.

Planted on 3rd June, 1932. Variety—Totadgin. 22 % Superphosphate—112lb. per acre. Seed—45lb. per acre.

Treatment.	Average Yields per acre. 1932.	Percentage Yields. 1932.	Averge Yields per acre. 1925-32.	Percentage Yields. 1925-32.
	bus. lb.		bus. lb.	
Fallow	40 0	100	23 54	100
Non Fallow	26 56	67	17 30	73

These results show definitely that decreased wheat yields can be expected when the land has not been fallowed.

The percentage results since 1925 illustrate the advantage of fallowing for the wheat crop.

Year.	Fallowed.	Unfallowed.
	%	%
1925	100 ...	38
1926	100 ...	58
1927	100 ...	87
1928	100 ...	44
1929	100 ...	72
1930	100 ...	104
1931	100 ...	88
1932	100 ...	67
Average	100	73

Time of Ploughing Experiment.

A Time of Ploughing Experiment has been conducted at this farm for the past nine years, with the object of determining the effects of early and late winter fallowing on the resultant crops grown on heavy land. For six years (1924-29) the experiment consisted of two plots, each half an acre in area, one representing early winter fallow, being ploughed during the first week of June, and the other late winter fallow, ploughed the last week of August.

The average results over this period are distinctly in favour of the early winter fallow.

Time of Ploughing.	Average Yield per acre, 1924-29.	Percentage Yields, 1924-29.
	bus. lb.	%
First week of June	18 46	100
Last week of August	14 55	80

In 1930 the experiment was slightly modified, a third plot being included, the times of ploughing being respectively mid-June, mid-July, and mid-August, and the area of the plots each one quarter of an acre.

After ploughing all plots were springtyne cultivated in September, harrowed in April, and disc cultivated immediately prior to seeding.

The results obtained are as follow:—

TIME FOR PLOUGHING EXPERIMENT.

Planted on 3rd June, 1932. Variety—Totadgin. 22 % Superphosphate—112lbs. per acre. Seed—45lbs. per acre.

Time of Ploughing.	Average Yields per acre. 1932.		Percentage Yields. 1932.	Average Yields per acre. 1930–32.		Percentage Yields. 1930–32.
	bus.	lb.	%	bus.	lb.	%
Mid July	34	46	86	26	32	87
Mid June	40	4	100	30	28	100
Mid August	22	8	55	19	58	66

The results emphasise the advantage of early ploughing.

Mulching Experiment.

The object of this experiment, which has been conducted since 1915, is to determine to what extent and under what conditions the cultivation of winter fallowed land is profitable during the spring and summer.

To meet the requirements of the experiment three plots were treated, as follows:—

Plot 1.—Cultivated during spring, again when required during summer after 25 points of rain or over, and again prior to seeding.

Plot 2.—Cultivated during spring and prior to seeding (ordinary fallow).

Plot 3.—Cultivated prior to seeding only (neglected fallow).

The land was ploughed to a depth of four inches during June, 1931. Plots 1 and 2 were springtyne cultivated in September, and Plot 2 received additional cultivations after the rain in January and again at the end of March. All plots were disc cultivated during early April.

The results obtained are set out below.

MULCHING EXPERIMENT.

Planted on 14th May, 1932. Variety—Totadgin. 22 % Superphosphate—112 lbs. per acre. Seed—45 lbs. per acre.

Treatment.	Computed Yields per Acre.										Average Yields per acre, 1932.		Percentage Yields, 1932.	Average Yields per acre, 1915-32*		Percentage Yields, 1915-32.*
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
Cultivated in Spring; during Summer; after rain, & before planting	27	40	21	10	19	40	27	0	26	20	24	22	95	21	52	101
Cultivated in Spring, and before planting	25	40	27	50	24	0	24	50	26	10	25	42	100	21	36	100
Cultivated before planting only	23	20	21	20	26	50	24	20	21	40	23	30	91	20	25	94

* Exclusive of 1931.

This year's results indicate an advantage in favour of the ordinary fallow.

The average results obtained over a period, extending back to 1915, indicate that the general practice should be to cultivate the fallow during spring and again prior to seeding, and where the ground is weedy, this cultivation should be supplemented by additional cultivations after rain during the summer months.

FIELD EXPERIMENTS WITH WHEAT, 1932.

SALMON GUMS EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.

L. G. SENIOR, Farm Manager.

In addition to the experiments published in the March issue of this Journal, the following experiments were conducted at the Salmon Gums Experiment Farm during 1932:—

Depth of Ploughing.

Time of Ploughing.

The following are the monthly rainfalls as recorded at the farm during 1932, together with the averages for the seven years the farm has been established:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total			
1932 ...	49	*Nil*	90	87	78	164	144	210	79	330	1,004	26	49	1,307
Avg. 7 yrs.	31	51	158	93	142	187	145	208	79	133	844	47	61	1,285

The total rainfall for the year was 1,307 points, being slightly over the average, while that for the growing period was 1,004 points, 160 points above the average for the same period.

Very little rain, however, fell early in the year. The latter half of April and almost the whole of May were unusually deficient of rain. The only falls of value registered during the month of May fell on the 29th and 31st, when 37 and 36 points respectively were recorded.

The delayed seeding rains were too late to enable the fallowed land to be planted in the desired wet condition. The germination of the early sown crops was also considerably retarded.

The rainfall from June to September was about the average, but particularly heavy rains were experienced during October. These, although late, proved of considerable value, particularly to the later maturing varieties. A number of frosts were recorded during the growing period, but little or no damage to the grain occurred.

The land on which the experiments were conducted carried originally silver bark and mallee, which had been rolled down during 1926. Previous to 1932 it had grown two crops, each on fallow. During 1931 it was ploughed with a disc cultivating plough to suit the requirements of the respective experiments. It was disced two inches deep towards the end of September, and again in April. The land was rigid tyne cultivated early in May and springtyne cultivated immediately prior to planting.

Depth of Ploughing Experiment.

The object of this experiment, which has been conducted for the past four years, is to determine the most economical depth to plough for the wheat crop.

Three plots, each repeated five times, were required, one ploughed to a depth of 2 inches, one to 4 inches, and one to 6 inches. The results are shown hereunder:—

DEPTH OF PLOUGHING EXPERIMENT.

Planted on 16th June. 1932. Variety—Gluyas Early. 22 % Superphosphate—112lbs. per acre. Seed—45lbs. per acre.

Depth of Ploughing.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1929-32.	Percentage Yields, 1929-32.
	bus. lbs.	bus lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
2in.	19 36	18 16	22 8	18 8	18 0	19 14	86	13 39	91
4in.	24 0	23 20	22 40	21 52	19 20	22 14	100	15 5	100
6in.	24 40	23 36	23 52	22 32	23 28	23 38	106	15 6	100

This year's results indicate an advantage in favour of the deep ploughing. The average results, obtained over a period of four years, however, indicate that there is no advantage to be gained by ploughing to a depth greater than 4 inches.

Time of Ploughing Experiment.

Three objects of this experiment is to ascertain whether the time of carrying out the initial operation of fallowing, *i.e.*, ploughing, has any effect upon the yield of the resultant wheat crop.

The plots, treated in the following manner, were required:—

Plot 1.—Ploughed in March, 1931. (Long summer fallow.)

Plot 2.—Ploughed in June, 1931. (Early winter fallow.)

Plot 3.—Ploughed in September, 1931. (Late winter fallow.)

The results obtained from the respective plots are shown below:—

TIME OF PLOUGHING EXPERIMENT.

Planted on May 16th, 1932. Variety—Gluyas Early 22 % Superphosphate—112lbs per acre. Seed—45lbs. per acre.

Time of Ploughing.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1928-32.	Percentage Yields 1928-32.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
March, 1931	23 28	20 16	20 8	20 0	21 12	21 1	93	13 43	92
June, 1931	23 44	22 24	21 36	22 8	22 48	22 32	100	14 55	100
September, 1931 ...	21 34	18 16	19 28	20 0	20 40	20 0	89	13 10	88

The results obtained this year, and the average results for the past five years, indicate that better results are obtained when the land is ploughed during the early winter months. Ploughing operations should, therefore, be commenced immediately after seeding has been completed.

FIELD EXPERIMENTS WITH WHEAT, 1932.

CHAPMAN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
F. L. SHIER, Farm Manager.

In addition to those experiments published in the March issue of this Journal, a Fallow v. Non-fallow Experiment was also conducted at the Chapman Experiment Farm during 1932.

The following table shows the monthly rainfalls, as recorded at the farm during 1932, together with the averages over the past 27 years:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
1932 ...	118	Nil	61	113	356	182	366	556	112	144	1,716	3	33	2,044
Avg. 27 yrs.	28	44	62	47	247	421	401	275	162	97	1,603	31	26	1,841

The season promised to open well with early April rains, which germinated weed seeds and enabled the fallowed land to be cultivated. Following these rains, however, a dry period, lasting until towards the end of May occurred. Strong drying winds were also experienced. Ideal seeding conditions then prevailed until planting operations were completed on the 20th June. During this period further cultivations were necessary to check weed growth on the fallow.

Heavy rains were experienced during July and August, the registrations for the latter month being particularly high. Satisfactory finishing rains fell during October.

Fallow v. Non-Fallow Experiment.

The object of this experiment, which has been conducted at this farm for four years, is to ascertain the comparative effect upon the yields of the resultant wheat crop, when sown on fallowed and unfallowed land.

The land on which the experiment was conducted, originally carried Jam and Wattle timber, and had been cleared for many years.

For the purpose of the experiment two sets of plots are required, the fallow plots being ploughed with a mouldboard plough during July, 1931, springtyne cultivated in September, again in April and May, and finally immediately prior to seeding, while the unfallowed plots were ploughed on 30th May, 1932.

The variety Nabawa was planted at the rate of 60 lb. per acre, and superphosphate applied at 112 lb. per acre. The fallow plots were repeated three times and the non-fallow twice.

The results obtained are as follow:—

FALLOW v. NON-FALLOW EXPERIMENT.

Planted on 4th June, 1932. Variety—Nabawa. 22 % Superphosphate—112 lbs. per acre.
Seed—60 lbs. per acre.

When Ploughed.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre. 1932.	Percentage Yields. 1932.	Average Yields per acre, 1929-32.	Percentage Yields, 1929-32.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
Fallow—Ploughed July, 1931	15 28	...	16 24	...	17 28	16 27	100	13 33	100
Non-Fallow—May, 1932	...	14 48	...	15 12	...	15 0	91	11 53	88

Both in this year's results and the average results for the four years the experiment has been conducted, the fallowed plots show to advantage.

FIELD EXPERIMENTS WITH WHEAT, 1932.

DAMPAWAH EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
F. GISHUBL, Farm Manager.

The following experiments were conducted at the Dampawah Experiment Farm during 1932 in addition to those published in the March issue of this Journal:—

Fallow v. Non-Fallow.

Time of Ploughing.

Depth of Ploughing.

Mulching Experiment.

The farm is situated 30 miles east of Perenjori, having been formerly a portion of Karara Station, on the fringe of the Lower Murchison.

The soil is a red friable loam, uniform in appearance, and was originally timbered with york gum, giant mallee, karara, and mulga scrub.

The land was cleared in 1927 and early 1928, and fallowed the same year. It was cropped in 1929 and in 1930; the stubble was utilised for grazing. During 1931 the land was ploughed with a disc cultivating plough to suit the requirements of the respective experiments. During late August and early September it was cultivated with a springtyne implement. Seeding was carried out with a combined cultivator drill.

The following table shows the rainfall registered at the farm since its establishment:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
1928 ...	*	*	*	*	164	94	238	142	71	34	743	6	156	*
1929 ...	17	220	64	...	267	234	60	62	18	33	674	120	...	1,095
1930 ...	...	..	93	123	48	404	160	93	22	41	768	31	54	1,069
1931 ...	...	12	3	25	237	113	232	95	131	40	848	179	120	1,187
1932 ...	49	...	56	46	138	91	205	302	59	125	920	6	79	1,156

* No records.

This year the rainfall for the growing period was the highest recorded since the establishment of the farm. Despite this, however, growing conditions were not ideal, particularly for the early and midseason varieties. No satisfactory falls were received until the 28th May and, in consequence, germination was delayed until early in June. During the latter month, which was comparatively dry, several severe frosts were experienced. Both these factors further retarded the growth of the crop.

Conditions were excellent throughout July and August, but during September only 59 points of rain was registered in three falls. In addition two severe frosts adversely affected the crops, particularly the early varieties.

Fallow v. Non-Fallow Experiment.

The object of this experiment is to ascertain the effect upon the resulting wheat crop of planting on fallowed and unfallowed land.

For the purpose of the experiment two sets of plots were required, the fallowed plots being ploughed in June, 1931, and the unfallowed plots in April, 1932. The results are as hereunder:—

FALLOW v. NON-FALLOW EXPERIMENT.

Planted on 2nd May, 1932. Variety—Gluyas Early. 22 % Superphosphate—90lbs. per acre. Seed—45lbs. per acre.

Treatment.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1930-32.	Percentage Yields, 1930-32.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs	%
Fallow	24 16	24 0	23 44	24 0	100	14 54	100
Non-Fallow	18 56	19 20	18 40	18 59	79	12 17	82

These results show that the yields of the wheat crop are increased when the land has been fallowed.

Time of Ploughing Experiment.

The object of this experiment is to ascertain whether the time of carrying out the initial operation of fallowing, *i.e.*, ploughing, has any effect upon the yield of the resulting wheat crop.

For the purpose of the experiment three plots were required:—

Plot 1.—Ploughed in April.

Plot 2.—Ploughed in June.

Plot 3.—Ploughed in August.

The results obtained are as follow:—

TIME OF PLOUGHING EXPERIMENT.

Planted on 3rd May, 1932. Variety—Gluyas Early. 22 % Superphosphate—90lbs. per acre. Seed - 45 lbs. per acre.

Time of Ploughing.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1932.	Percentage Yields, 1932.	Average Yields per acre, 1930-32.	Percentage Yields, 1930-32.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
April, 1931	22 0	22 0	21 4	20 16	19 12	20 54	96	13 58	95
June, 1931	22 48	22 40	21 12	22 0	20 32	21 50	100	14 40	100
August, 1931	21 12	20 56	21 12	19 52	18 48	20 24	93	13 53	95

The results for this year and the average results obtained over the three years that the experiment has been conducted indicate that the yields are increased when the land is ploughed during the early winter months. These are in conformity with somewhat similar experiments conducted at the other experiment farms.

Depth of Ploughing Experiment.

The object of this experiment is to determine the comparative effects upon the resultant wheat crop of ploughing the land to different depths.

For the purpose of the experiment three plots were required, and they were ploughed early in July, 1931, to the respective depths of 2 inches, 4 inches, and 6 inches, the whole experiment being repeated five times.

The plots were planted with a combined cultivator-drill on the 3rd May, the variety, Gluyas Early, being planted at the rate of 45 lb. per acre, and superphosphate applied at the rate of 90 lb. per acre.

The results obtained are as follow:—

DEPTH OF PLOUGHING EXPERIMENT.

Planted on 3rd May, 1932. Variety Gluyas Early. Seed—45 lbs. per acre. Superphosphate—90 lbs. per acre

Depth of Ploughing.	Computed Yields per Acre.										Average Yields per acre, 1932.		Percentage Yields, 1932.	Average Yields per acre, 1930-32.		Percentage Yields, 1930-32.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
2 inches	18	0	18	0	18	24	18	40	18	32	18	19	94	12	52	94
4 inches	19	20	19	36	20	8	19	28	18	56	19	30	100	13	45	100
6 inches	19	36	19	36	19	44	19	4	18	56	19	23	99	13	43	100

The results for this year, and also the average results obtained over the period of three years that the experiment has been conducted, indicate that it is most economical to plough to a depth of 4 inches.

Mulching Experiment

This experiment is conducted in order to determine to what extent the cultivation of winter fallowed land is profitable during the spring and summer months.

Three series of plots were necessary to fulfil the requirements of the experiment, and they were treated as follows:—

Plot 1.—Cultivated prior to seeding only (neglected fallow).

Plot 2.—Cultivated during spring and prior to seeding (ordinary fallow).

Plot 3.—Cultivated during spring, again when required during summer after 25 points of rain or over, and again prior to seeding, the object being to maintain a mulch throughout the fallowed period and to destroy weed growth.

All plots were ploughed during July, 1931, and subsequently received the following cultivations with a springtyne implement:—

Plot 1.—Cultivated at seeding time only.

Plot 2.—Cultivated in July, 1931, and at seeding time.

Plot 3.—Cultivated in July, September, October, November, December, and at seeding.

The results obtained are as follow:—

MULCHING EXPERIMENT.

Planted on 3rd May, 1932. Variety—Gluyas Early. Seed—45 lbs. per acre. Superphosphate—90 lbs. per acre.

Treatment.	Computed Yields per Acre.										Average Yields per acre, 1932.		Percentage Yields, 1932.	Average Yields per acre, 1929, 30, and 1932.		Percentage Yields, 1929, 30, and 1932.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
Cultivated before seeding only	20	24	20	48	20	8	21	20	21	52	20	54	98	17	49	100
Cultivated in spring and before seeding	21	4	21	4	21	12	22	0	21	20	21	20	100	17	47	100
Cultivated in spring during summer after rain and before seeding	20	48	21	36	20	0	21	36	19	52	20	46	97	17	8	96

These results do not indicate that any advantage is derived from cultivating fallow during the spring or summer months at this farm. Lack of response to the spring cultivations may possibly be due to the friable nature of the soil and the fact that, being new land, there is as yet practically no weed growth.

ENTOMOLOGICAL NOTES.

B. A. O'CONNOR, B.A., B.Sc. Ag.

Identity of White Wax Scale.

In the "Agricultural Gazette" of New South Wales, August, 1932, Mr. E. H. Zeck pointed out that the wax scale infesting citrus in New South Wales was not, as was formerly considered, the Indian *Ceroplastes ceriferus*, but the African species *Ceroplastes destructor*. He expressed the opinion that the White Wax Scale of citrus in West Australia was probably *C. destructor*, and an examination of the scale in this State reveals that it agrees with his description of *C. destructor*. Hence, previous published references to White Wax Scale of citrus in West Australia apply to *Ceroplastes destructor*.

The Vine Scale and its parasite.

The Vine Scale, *Eulecanium persicae Fabr.* (*Lecanium cymbiformis Targ.*, *L. berberidis Sign.*) was in the early years of this century a bad pest of the grape vine, plum, pear, peach, nectarine, mulberry and apricot. About 1910, Mr. George Compere introduced a parasite which has since controlled the scale with great efficiency. The identity of this parasite was not known, though it was believed to be a species of *Aphycus*. In 1932, specimens sent to Mr. A. A. Girault of the Queensland Department of Agriculture, were identified as *Aphycus timberlakei Ishii*, originally described in 1923 from specimens which issued from a species of *Lecanium* on *Euonymus* at Nagasaki, Japan. The male is black, the female having a brown head and thorax with black and white markings, on antennae and abdomen, wings with a dark discal patch.

The cat-louse, Trichodectes subrostratus Nitzsch.

The first record of the occurrence of this louse in Western Australia was made on April 11, 1933, when specimens were taken on a cat at South Perth.

Violet Aphis.

On May 24, 1933, Mr. L. J. Newman collected some aphids from the under-sides of the leaves of violets at Claremont. These proved to be ***Rhopalosiphum violae Pergande,*** which has not previously been recorded from this State, or from Australia, to the writer's knowledge. This aphid is easily distinguished by the dark red colour of the abdomen and the broad black wing-veins.

Calliphora nociva.

In the Bulletin of Entomological Research for December, 1932, G. H. Hardy described a species of *Calliphora* under the name *Calliphora nociva.* This description appeared to fit an unnamed species of *Calliphora* occurring commonly in this State, and confirmation of this belief was forthcoming when specimens were submitted to Mr. Hardy. Data as to the distribution of this fly in Western Australia may be found in an article on the seasonal and regional incidence of Western Australian blowflies appearing in the "Journal of Agriculture," December, 1930. In this article, *Calliphora nociva* is referred to as *Calliphora* sp.

THE BLOW-FLY PROBLEM.

OFFICIAL REPORT AVAILABLE.

Copies of the first report issued by the Joint Blow-Fly Committee, appointed by the Council for Scientific and Industrial Research and the New South Wales Department of Agriculture, have now been received in Western Australia, and are obtainable at the Department of Agriculture at a cost of 1s. 6d. per copy, post free.

The report, which is edited by Dr. R. J. Tillyard, of the Division of Economic Entomology, and Dr. Seddon, Director of Veterinary Research, N.S.W., is a comprehensive statement setting out our present knowledge of the blow-fly problem as a whole and the research work already accomplished by former and present investigations in Australia. It deals comprehensively with our knowledge of strike, *i.e,* the condition produced by the presence of blow-fly maggots on the living sheep, and the flies are classified into primary and secondary flies according to their ability to initiate strike. The report is accompanied by a plate giving a reproduction in colours of the flies of economic importance in connection with the sheep problem, and it is considered that this report should enable pastoralists and farmers to determine which flies are responsible for their particular conditions. The life history and the conditions favouring propagation of the blow-fly are discussed in detail, so that the various methods by which the pest may be combated can be readily understood.

As supplies of the report in Western Australia are limited, it is suggested that early application be made to the Department of Agriculture for copies, accompanied by stamps or money order to the value of 1s. 6d.

FALLOW COMPETITION, 1932.

KARLGARIN AGRICULTURAL SOCIETY.

Judge: A. S. WILD, Agricultural Adviser.

Seven competitors submitted fallows for inspection in the 50-acre fallow competition conducted by this Society. Awards were made as shown in the following table:—

Competitor.	District.	Moisture. 40 points.	Mulch. 10 points.	Freedom from Weeds. 10 points.	Consolidation of Seedbed. 20 points.	Uniformity of Preparation. 20 points.	Total. 100 points.
James, S. W. ...	Karlgarin ...	38	8	9	18	18	91
Medcalf	Karlgarin ...	36	9	8	18	18	89
Clayton, R. G. ...	North Hyden Rock	38	8	7	18	17	88
Marshall, H. J.	Hyden Rock ...	37	8	8	18	17	88
Grant, L. J. ...	Karlgarin ...	35	8	9	16	17	85
Green & Atkinson	North Hyden Rock	37	8	7	16	17	85
Trestrail, S. J. ...	Karlgarin ...	34	6	8	17	17	82

The competition was won by Mr. S. W. James, of Karlgarin. Mr. James' fallow has been carefully prepared; the mulch was perhaps a little too fine, but the consolidation of the seed bed was satisfactory, except on portions of "snuffy" morrel soil. In addition, the fallow was very clean of weed growth.

Mr. C. W. Medcalf's fallow, which was awarded second place, lost additional points for moisture and weed growth. In other respects it was equal to the winning entry.

The rainfalls recorded from June to January, inclusive, are as follows:—

Centre.	Fallowing Rains.				Spring Rains.			Summer Rains.				Total June-Jan.
	June.	July.	Aug.	Total.	Sept.	Oct.	Total.	Nov.	Dec.	Jan.	Total.	
Karlgarin ...	96	254	290	640	127	277	404	5	9	38	52	1,096
Sth. Hyden Rock	108	244	210	562	73	278	351	...	4	54	58	971
Nth. Hyden Rock (Camel Peaks)	125	282	267	674	99	270	369	...	...	?	...	...

The cultural details of the competitors are summarised in the table hereunder:—

CULTURAL DETAILS.

Competitor.	Timber.	Cleared.	Ploughed.	Implement.	Depth of Ploughing.	Condition of Land at Ploughing.	Other Cultivations.
					inches.		
S. W. James	Salmon and Morrel	1923	April ..	Disc ...	2½	Dry	Rigidtyne cultivated 3in. deep late June and again late August.
C. W. Medcalf	Mallee, Salmon and Gimlet	1927	Early July ...	Disc ...	3—4	Wet	Springtyne cultivated 4in. deep in August; Springtyne cultivated 2in. deep in September and again in October.
R. G. Clayton	Salmon and Mallee	1930	Late June ..	Disc .	3	Wet	Springtyne cultivated in September.
H. J. Marshall	Salmon and Gimlet	1931	Early June ...	Disc ..	3	Good	Springtyne cultivated in August: again in September, and again in October.
L. J. Grant	Salmon and Mallee	1927	July ...	Disc ...	3—4	Wet	Springtyne cultivated in August and again in September.
Green & Atkinson ...	Salmon, Gimlet Mallee and Tea-tree	1927	Late June ...	Disc ...	3	Wet	Springtyne cultivated in August and again in November.
S. J. Trestrail	Salmon and Mallee	1926	July ...	Mouldboard	2½—3	Wet	Rigidtyne cultivated in October.

FALLOW COMPETITION, 1932.

MERREDIN AGRICULTURAL SOCIETY.

Judge: A. S. WILD, Agricultural Adviser.

For the 50-acre Fallow Competition conducted by this Society there were nine competitiors.

The rainfall recorded from June to January, inclusive, is shown in the table hereunder:—

Centre.	Fallowing Rains.				Spring Rains.			Summer Rains.				Total June to Jan.
	June.	July.	Aug.	Total.	Sep.	Oct.	Total.	Nov.	Dec.	Jan.	Total.	
Merredin	92	289	286	667	79	296	375	...	15	23	38	1,080
Ulva	98	343	297	738	57	339	396	...	14	27	41	1,175
Belka	147	325	319	791	91	305	396	2	14	...	...	...
Baandee	74	234	353	661	70	296	366	7	...	10	17	1,034
Burracoppin ...	105	291	224	630	32	292	324	...	25	11	36	990
South Burracoppin	82	289	245	616	156	324	480	...	13	36	49	1,145
Nukarni	93	277	231	601	75	263	338	...	22	9	31	970

The winning entry, that of Mr. J. Kay, was a good even fallow, showing evidence of careful workmanship. The mulch was very fair, whilst the consolidation of the seed bed was excellent.

Points were lost for weed growth, which consisted only of Prickly Potato weed (Solanum hoplopetalum) scattered over the fallow, all others having been effectively dealt with by stocking heavily with sheep during the spring months.

Two competitors tied for second place, Messrs. McPharlin and Sons, of South Burracoppin, and Mr. E. E. Reichelt, both being awarded 90 points.

Although the consolidation of the seed bed of Messrs. McPharlin and Sons' fallow was good, the mulch had apparently been worked a little too fine, and a few hard patches had formed.

The mulch of Mr. Reichelt's entry would, perhaps, have improved with an extra cultivation.

The cultural details of the competitors are summarised in the following table:—

Competitor.	District.	Moisture. 40 pts.	Mulch. 10 pts.	Freedom from Weeds. 10 pts.	Consolidation of Seed bed. 20 pts.	Uniformity of Preparation. 20 pts.	Total. 100 pts.
Kay, J.	Baandee	36	9	8	19	19	91
McPharlin & Sons ...	South Burracoppin	36	8	9	19	18	90
Reichelt, E. E. ...	North Burracoppin	36	8	8	19	19	90
Smallacombe, T. H. ...	Merredin ...	37	8	7	19	18	89
Teasdale, H. W. ...	Ulva	35	9	9	17	19	89
Flockhart, I. H. ...	Belka	34	8	8	19	18	87
Teasdale, F. O. ...	Korbel	33	8	9	19	18	87
Cockram, W. H. ...	Nukarni	33	8	7	19	18	85
Clothier, J. C. ...	Ulva	30	8	8	19	18	83

CULTURAL DETAILS.

Competitor.	Timber.	Cleared.	Ploughed.	Implement.	Depth of Ploughing.	Condition of Land at Ploughing.	Other Cultivations.
J. Kay	...	...	June and early July	Mouldboard	inches. 4	...	Cross cultivated with rigid-tyne cultivator in August, afterwards heavily stocked with sheep.
McPharlin & Sons .	Gimlet	1926	June	Disc	3	Good to Hard	Springtyne cultivated 3in. deep early July; Springtyne cultivated middle of August and again late October.
Reichelt, E. E.	Salmon and Gimlet	Old land	April	Disc	3½	Good	Harrowed in June. Rigidtyne cultivated in June and again in September.
Smallacombe T. H ...	Salmon and Mallee	1927	June	Disc	4	Wet	Springtyne cultivated twice in September.
Teasdale, H. W. ...	Gimlet and Salmon	Old land	June and July	Mouldboard	3½	Good	Rigidtyne cultivated in early September and again in late October.
Flockhart, I. H. ...	Salmon and Gimlet	Old land	June	Mouldboard	2½	Hard	Springtyne cultivated in August and again in September.
Teasdale, F. O.	Gimlet	1924	Late July	Mouldboard	3	Good	Springtyne cultivated in August, again in September, and again in October.
Cockram, W. H. ...	Tea-tree, Mallee and Gimlet	1912	July	Disc	3½–4	Good	Springtyne cultivated in October.
Clothier, J. E.	Jam, Mallee and Gimlet	Old land	July	Disc	3	Excellent	Springtyne cultivated in September, again in October, and again in January.

50 ACRE FALLOW COMPETITION.

BRUCE ROCK AGRICULTURAL SOCIETY.

Judge—R. P. ROBERTS, Agricultural Adviser.

Five entries were judged in the above competition, the awards being as follow:—

Competitor.	District	Moisture. 40 points.	Condition of mulch. 10 points.	Absence of weeds 10 points	Consolidation of seed bed. 20 points.	Uniformity of preparation. 20 points.	Total. 100 pts.
Pimlott, S. H. ..	Kwolyin	38	8	9	17	18	90
Smith, C. & A. H. .	Yalbarrin	36	8	9	16	17	86
Brown, S. A.	Bruce Rock	35	7	9	17	17	85
Farrall & Sons, F. C.	Yarding	35	7	9	16	17	84
Smith, C. & Sons	Yarding	34	7	9	16	16	82

The competition was won by Mr. S. H. Pimlott, of Kwolyin, with an entry which gained 90 points. The land, which had previously carried gimlet and salmon gum, was worked in a two-year rotation of fallow and wheat. The most notable feature of this entry was the high moisture content of the grey sandy clay subsoil.

It was noticed that several of the fallows inspected had been worked with implements with one or more strained or incorrectly adjusted tynes. This caused a certain amount of ridging of the seed bed and consequent loss of points.

The rainfalls recorded at the various centres in the district were as follow:—

Centre.	1932							1933.			Total.
	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	
Bruce Rock ..	99	288	355	62	340	...	8	25	4	34	1,215
The Granites	76	301	342	131	424	...	18	...	...	...	...
Bruce Rock South ..	96	280	262	75	312	...	17	38	..	43	1,123

The cultural details are given in the accompanying table.

BRUCE ROCK AGRICULTURAL SOCIETY.

FIFTY ACRE FALLOW COMPETITION.

CULTURAL DETAILS.

Competitor.	Original Timber.	When Cleared.	When Ploughed.	Implement.	Depth of Ploughing.	Condition of Land.	Subsequent Cultivations.	Rotation.	Sheep.
Pimlott, S. H.	Gimlet and Salmon gum	Old land	June	Rigidtyne Cultivator	3in.	Good	Springtyne cultivated in August and again after rain in October	Fallow-Wheat	Yes
Smith, C. & A. H. ...	Salmon gum and Gimlet	Old land	June .. .	Rigidtyne Cultivator	3in	Good	Rigidtyne cultivated end of July; Springtyne cultivated after rain in October	Fallow-Oats-Fallow-Wheat	Yes
Brown, S. A.	Gimlet and Salmon gum	Old land	June	Rigidtyne Cultiv. tor	3in	Good	Rigidtyne cultivated in October	Wheat-Oats-Fallow	Yes
Farrall, F. C. & Sons ...	Salmon gum, Gimlet and Mallee	Old land	Early June ...	Disc Cultivating Plough	3in.	Good	Rigidtyne cultivated in July and again in September. Springtyne cultivated October-November	Fallow-Oats-Pasture-Pasture-Fallow	Yes
Smith, C. & Sons ...	Salmon gum and Gimlet	Old land	Portion with Rigidtyne in July. All ploughed in August.	Disc Cultivating Plough	2½in.–3in	Good	Disced in September; springtyne cultivated and part scarified after rain in October	Wheat-Oats-Fallow	Yes

50 ACRE FALLOW COMPETITION.

NUNGARIN AGRICULTURAL SOCIETY.

Judge—R. P. ROBERTS, Agricultural Adviser.

Nine entries were received for this competition, which was judged at the end of March, 1933. The rain gaugings at the various centres in the district were as follow:—

Centre.	1932.							1933.			Total, June to December.
	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	
Mangowine	45	273	270	49	192	..	...	19	33	11	892
Nukarni ..	93	277	231	75	263	...	22	9	...	22	992
Nungarin	66	279	262	60	239	...	45	11	4	65	1,031
Kooroloo .. .	69	293	262	60	276	...	45	11	4	65	1,025

The points awarded are set out in the accompanying table:—

Competitor	District.	Moisture.	Condition of Mulch.	Absence of Weeds.	Consolidation of Seed bed.	Uniformity of Preparation.	Total.
		40 points.	10 points.	10 points	20 points.	20 points.	100 pts.
Jolly, H.	Nungarin ..	33	8	9	18	19	87
Jolly, J. ..	Nungarin ...	33	8	9	18	17	85
Creagh Bros. ...	Kwelkan ..	35	7	9	16	17	84
Evans, L. D. ...	Nukarni ...	33	8	8	17	18	84
Green, T. W. ...	Kwelkan ...	32	8	9	16	18	83
Jolly, R.	Nungarin ..	33	7	9	17	17	82
Williams, F. A. ...	Mangowine ...	31	8	7	18	17	81
Francis, Mrs. ..	Nungarin ...	32	8	5	18	18	81
Hoare, H. L. J. ..	Burran Rock .	30	7	9	17	17	80

The competition was won by Mr. H. Jolly with an entry which gained 87 points. The land had originally carried gimlet, salmon gum, tea-tree, and some scattered morrel. The entry submitted was very even in appearance and had a good loose mulch, which was, if anything, rather too fine. This, however, could not be avoided on the particular type of country.

It was noticed that several competitors had worked their fallows dry shortly before judging. Little, if any, benefit can result from this practice, and if take-all is prevalent, this is one of the surent means of spreading the infection.

The cultural details are set out in the accompanying table:—

NUNGARIN AGRICULTURAL SOCIETY.

50 ACRE FALLOW COMPETITION.

CULTURAL DETAILS.

Competitor.	Original Timber.	When ploughed.	Implement	Depth.	Condition of Land.	Subsequent Cultivations.	Sheep.
Jolly, H.	Salmon gum, gimlet, tea-tree, and scattered morrel	June	Mouldboard ...	3½-4in.	Very Good ...	Harrowed in August: Springtyne cultivated in March.	Yes
Jolly, J.	Salmon gum and gimlet ...	June	Rigidtyne scarifier	4in.	Good	Rigidtyne scarified in September and harrowed (dry) at the beginning of March	No
Creagh, Bros.	Salmon, gimlet, yorrel, mallee, and some scrub	July	Gaston disc ..	4in.	Good	Rigidtyne scarified at the end of September	Yes
Evans, L. D.	Salmon gum and gimlet ..	June	Mouldboard and a little with disc cultivating plough	3in.	Good	Harrowed end of July: Rigidtyne scarified in August. Harrowed and Springtyne cultivated in October.	Yes
Green, T. W.	Salmon gum, gimlet and mallee	June	Disc cultivating plough	3–4in.	Good	Springtyne cultivated in July. Cultivated with a disc implement in August to kill weeds. Springtyne cultivated after rain in December, and again after rain in March	Yes
Jolly, R.	Salmon gum, gimlet and manna	End of July ...	Rigidtyne scarifier	4in.	Good	Skim ploughed in September with a mouldboard, harrowed (dry) at the beginning of March.	No
Williams, F. A.	Salmon gum, gimlet and mallee	June	Rigidtyne scarifier	3in.	Good	Rigidtyne scarified in September, and harrowed (dry) in March.	Yes
Francis (Mrs.)	Salmon gum and gimlet ...	July	Disc cultivating plough	4in.	Good	Rigidtyne scarified and harrowed in Spring	Yes
Hoare, H. L. J. ...	Salmon gum, jam scrub, gravel scrub-plain, mallee	July	Disc cultivating plough	3in.	Good	Rigidtyne scarified in September	Yes

FALLOW COMPETITION, 1933.

PHILLIPS RIVER AGRICULTURAL SOCIETY.

Judge—A. S. WILD, Agricultural Adviser.

Six entries were submitted for inspection in the fallow competition conducted by the above society, awards being made as follow:—

Competitor.	District.	Moisture. 40 points.	Mulch. 10 points.	Absence of Weeds. 10 points.	Consolidation of Seed-bed. 20 points.	Uniformity of Preparation. 20 points.	Total. 100 pts.
Bebbington Bros. ...	Mt. Short ...	35	9	9	19	19	91
Skinner, E.	Ravensthorpe...	36	9	8	19	18	90
McCullock. J. ...	Ravensthorpe...	36	8	8	19	18	89
Campbell, J.	Mt Short ...	35	8	7	19	18	87
Dasborough, S. C. B.	Ravensthorpe...	36	7	8	18	18	87
Love, J. W.	Ravensthorpe...	35	8	6	18	18	85

The monthly rainfalls as recorded from June to March inclusive at Ravensthorpe and Mt. Short, respectively, are shown below:—

Centre.	Fallowing Rains.				Spring Rains.			Summer Rains.						Total, June to Mar.
	June.	July.	Aug.	Total.	Sept.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Mar.	Total.	
Ravensthorpe ...	198	145	235	578	167	430	597	62	7	86	Nil	247	402	1,577
Mt. Short ...	158	186	171	515	136	379	515	26	5	53	Nil	181	265	1,295

The winning entry, that of Messrs. Bebbington Bros., was an excellent, well-prepared fallow. The land had been ploughed to a depth of 3½ inches with a mouldboard plough during the previous July. The subsequent cultivations with a springtyne implement had resulted in a good consolidated seed-bed and an excellent mulch. Very little weed growth was in evidence.

Generally the fallows entered in this competition all showed a high moisture content, but this was due to rains which had fallen but a short time prior to inspection.

The cultural details of the competing fallows are shown hereunder:—

PHILLIPS RIVER AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1933.

CULTURAL DETAILS.

Competitor.	Original Timber.	Years Cleared.	When Ploughed.	Implement.	Depth.	Condition of Land.	Subsequent Cultivations.
Bebbington Bros. ...	Salmon, gimlet, mallee, mort	Four	Mid July ...	Mouldboard ...	3½in.	Good	Springtyne cultivated early September and again early November, after rain. Portion springtyne cultivated after rain early in January.
Skinner, E.	Mallee and gimlet ...	Seven	Late July ...	Mouldboard ...	4in.	Good	Springtyne cultivated early September, and again in October.
McCullock, J.	Mallee and salmon ...	Seven	July . ..	Mouldboard ..	4in.	Good	Springtyne cultivated early September.
Campbell, J.	Salmon and jam ...	Old land ..	Early June ...	Mouldboard ...	3½–4in.	Good	Springtyne cultivated early September.
Dasborough, S. C. B. ...	Mallee, salmon and gimlet	Old land ...	July–August ..	Mouldboard ...	4in.	Good	*Nil.*
Love, J. W.	Mallee and broomebush	Old land ...	Late June ..	Mouldboard ...	4in.	Good	Springtyne cultivated mid September, and portion again Springtyne cultivated late September.

UNTHRIFTINESS OF MERINO WEANERS DUE TO WORM INFESTATION.

H. W. BENNETTS, D.V.Sc.

It has been stated frequently by sheep owners in the agricultural districts that their Merinos do not "do well" during the first year of life. Of recent years it has become apparent on certain properties in the Midland and Great Southern Districts that something serious is amiss. Despite good nutritional conditions, a large percentage of lambs receive a severe check in growth after weaning and mortalities of more than 15 per cent. have been experienced. Investigation, as yet incomplete, indicates that the disease is due to heavy worm infestation with species other than *Haemonchus contortus*, the barber's pole worm.

We have reason to believe that this weaner trouble is rather widespread, though on account of the insidious nature of the disease it is apt to be overlooked for some time. Poor success in the rearing of weaners is ascribed, probably, to seasonal or nutritional influences, and it may not be recognised for a few years that some other factor is responsible. The purpose of this article is to describe the complaint and to recommend owners of flocks so affected to give early and systematic worm treatment a trial.

Until quite recently it had been accepted generally that *Haemonchus contortus* was economically the most important worm affecting the gastro-intestinal tract of sheep. It was considered, also, to be the chief cause of parasitic complaints of sheep in this State, and treatment has been recommended accordingly. It is now known that other species of worms, particularly *Trichostrongyles*, are quite as important and are more frequently the cause of trouble in young sheep. Seddon* and Edgar† give an account of trichostrongylosis (the condition due to infestation with these worms) in N.S.W. which accurately describes the Merino weaner trouble observed in Western Australia. Further, on properties where the disease has been investigated locally heavy infestations with *Trichostrongyles* have been associated. On one of these properties, where serious difficulty has been experienced, the institution of suitable worm treatment appears to have definitely overcome the trouble.

THE WORMS RESPONSIBLE.

(i) *Trichostrongylus spp.*—There are several species of these "hair worms" which affect sheep. They are very minute worms less than half an inch in length and as thin as a fine hair. They are found in the small intestine and are most numerous in the first 15 feet from the fourth stomach, exclusive of the first 3 feet. They usually lie coiled up on or in the inner lining of the bowel, and, being bloodsuckers, stand out red against the whitish background. They can be fairly readily seen on a bright day with the naked eye, but the use of a hand lens is a valuable aid, particularly in dull weather. Other larger worms, notably *Ostertagia spp.* and *Nematodirus filicollis* may also be found in the small intestine, but in cases we have examined *Trichostrongylus spp.* were particularly numerous and few other worms were present in that situation. *Trichostrongylus* also occurs in small numbers in the fourth stomach. An indication of the numbers present in the small bowel of an animal, which has died or been killed for examination, can

* Seddon, H. R.—*Agricultural Gazette*, N.S.W., 44: 288, 1933.
† Edgar, G.—*Ibid.*, 44: 383, 1933.

be arrived at by the following procedure:—Several feet of the small bowel (between 3-15 feet from the fourth stomach) are removed, the ends having been tied off previously to prevent escape of contents. The bowels are then slit up with scissors so that the contents and opened bowel are received into a mason jar containing water. Water is then added until jar is about two-thirds full, the cap is screwed on and the container is vigorously shaken for several minutes in order to, as far as possible, wash the parasites from the bowel wall. The bowels are then removed from the jar which is stood for about one hour to allow the worms to sediment to the bottom. The fluid is then carefully poured off until only about one inch remains on the bottom and the jar is again filled with water to about two-thirds capacity. Shake once more for a few moments and stand again for an hour or so to allow majority of worms to sediment to the bottom. Pour off the bulk of fluid as before. By this time much of the debris will have been removed and a small quantity of the residual fluid, which may be further diluted if too turbid, is poured into a shallow glass dish. If this is placed over a dark surface numerous minute whitish hair-like worms can be seen on looking through the fluid. Occasional agitation of the vessel will assist detection of the parasites, and it is preferable to use a hand lens for this purpose.

(ii) *Ostertagia spp.*—These worms also belong to the same group as *Trichostrongylus* and are referred to as *Trichostrongyles.* They are dark brown worms up to half-an-inch in length and stouter than *Trichostrongylus. Ostertagia* occurs principally in the fourth stomach. A careful scrutiny of the lining will reveal the parasite if present and it is distinguished from *Haemonchus contortus* by its colour and smaller size. These worms are known to produce serious effects, and we have found them in enormous numbers in lambs only five weeks old in association with *Trichostrongylus.*

The life history of *Trichostrongyles* is stated to be similar to that of *Haemonchus contortus*, though it appears evident that they are both better able to withstand dry and cold conditions than the barber's pole worm. Infestation results from the ingestion of the infective larvae, or young forms, with pasture.

THE DISEASE (TRICHOSTRONGYLOSIS).

Merinos are said to be particularly susceptible to this complaint, and it has been noted, here, that crossbreds can be reared successfully on properties where *Trichostrongyles* cause trouble in Merinos. Trichostrongylosis is essentially a disease of lambs and young hoggets—older sheep running with them remain healthy. It appears first in the early spring and carries on through the summer and autumn.

Symptoms.—The chief symptoms are stunting and black scours. The check in growth usually noted about weaning time is soon followed by persistent "black scours." Affected lambs lose their vitality and gradually become poorer, despite good feeding. They become progressively weaker, there is loss of appetite, and they die from malnutrition. Those which survive the summer and autumn commence to pick up following the appearance of the new season's green feed, and recover although their small size is apparent for some months. As one would expect there is a break in the wool when they are shorn as hoggets. When first affected lambs are not anaemic, the skin appearing quite pink and healthy. They do become anaemic, however, after the disease has been present for some weeks. Pot belly and bottle jaw are absent, although they may be observed in the later stages of the disease, probably as a result of a complicating infestation with *Haemonchus contortus* which may occur as the animal becomes older.

Haemonchosis, the condition due to infestation with *Haemonchus contortus*, differs from trichostrongylosis in that all breeds are susceptible; it does not appear here until summer. Stunting is not noticeable, scouring is inconsistent, but anaemia is a marked and early symptom and pot belly and bottle jaw are common. Haemonchosis may affect sheep of all ages though we have not observed it in lambs under eight or nine months old. It is rapidly fatal. Trichostrongylosis, on the other hand, only affects young animals and the course of the disease is slow and protracted.

Treatment.—It is considered that the stunting of Merino weaners experienced in certain districts in this State is due to heavy infestations with *Trichostrongylus spp.* during the early life of the lamb. The effect of this early infestation, commencing when lambs begin to eat pasture, becomes manifest after weaning. Although apparently healthy when taken from their mothers, they have insufficient resistance to stand up to the changed dietetic conditions and the worm infestation which is, of course, continuous.

It has been shown in this State that worm treatment commenced in September, as recommended for haemonchosis, is ineffective for trichostrongylosis and does not arrest the progress of this complaint, even when special attention is paid to diet. In one case lambs which were taken off their mothers in really good condition collapsed when depastured on self-sown oats and trefoil, although treated systematically for parasites from September onwards. None of the remedies recommended for *H. contortus* are nearly so effective against *Trichostrongylus*, and experience in this State is showing that the only way of controlling weaner trouble due to *Trichostrongyles* is to commence worm treatment at tailing time. When lambs are a month old they should be drenched, by means of a syringe, with 3 c.c. of a mixture of equal parts of tetrachlorethylene and liquid paraffin. The treatment should be repeated at monthly intervals, the dose being increased to 5 c.c. as the lambs get older. Tetrachlorethylene is a very safe preparation to use although the transient stupefying action following its administration may cause some concern to those who have not previously used the drug.

The copper sulphate (bluestone) solution as recommended for *Haemonchus contortus*, has been stated to be somewhat more effective than tetrachlorethylene against *Trichostrongylus*. The objection to its use for young lambs is the necessity for preliminary starvation, which does not apply in the case of tetrachlorethylene. Further, a tetrachlorethylene preparation has been shown to give good results on the property referred to above when used as indicated. There appears to be no reason why the usual bluestone treatment should not be substituted when lambs are older and better able to withstand starvation prior to drenching.

Naturally it is essential to build up the lambs with the best possible diet to supplement the vermifuge treatment. Both measures are necessary and effective control will not be achieved if either is forgotten.

ERRATA.

In the March issue of this Jonrnal, pp. 70-72, an article dealing with Fertiliser Trials at Herdsman's Lake appears in which tables are shown as Treatment in Tons per acre. This is an obvious error and should be read as cwts. per acre, and not tons as shown.

INSECT PESTS OF FRUIT TREES AND THEIR CONTROL.

By L. J. Newman, F.E.S., Government Entomologist,
and B. A. O'Connor, B.A., B.Sc.Ag.

In this article an effort has been made to bring together the recommended control measures for the more important orchard pests. The control of most insect pests is rendered less difficult or complicated if growers bear in mind one or two simple facts, which can be quickly learned by watching the habits of the insects causing the damage.

Insects are divided into two general groups or classes according to the mouth parts and type of injury they do. The chewing or biting insects are known as the Mandibulata. These feed by actually biting a piece out of the plant. The other class is known as the Haustellata, or sucking insects, which suck the juices out of the leaves, stems or fruit without, as a rule, showing any definite external injury to the part attacked. To be able to determine to which of these two classes of insects the pest belongs is the first essential to intelligent and successful control. What to apply in the way of a check or control is bound up in this rudimentary knowledge. Failure to control an insect pest is frequently due to the application of the wrong spray.

Biting insects, as a class, are usually controlled by covering the plants upon which they feed with a poison, such as arsenate of lead, applied either as a spray or in dust form. This is taken into the stomach with the food and subsequently causes death. Sucking insects, on the other hand, inasmuch as they do not take pieces of plant tissue into the intestine, cannot be killed by a stomach poison. These insects, are, therefore, treated with contact sprays or dusts, which either kill by contact, or else give off fumes which will destroy them, when taken into the respiratory system.

Caterpillars, beetles, grasshoppers, etc., belong to the first class, while aphids, scales, plant bugs, etc., come into the second class. What a grower has to do, therefore, is to correctly determine the nature of the damage, and to apply either a stomach poison or a contact spray or dust. If any doubt exists, specimens of the pest should be forwarded to the Entomological Branch for prompt determination. In the use or application of either a spray or dust it is essential to see that they are carefully measured, mixed and applied. In pouring the spray material into the spraying machine it should always be passed through a strainer, otherwise the valves and nozzles are bound to become blocked, causing considerable delay and annoyance.

Great care and thoroughness are necessary in spraying, because if this is badly done most of the effectiveness of the treatment will be lost. In the case of stomach poisons, the whole foliage of the plant or tree must be thoroughly covered, while in the case of contact sprays, all the insects must be brought into thorough and forceful contact. It is, therefore, essential that both sides of the leaves should be sprayed, particularly the under sides where the insects chiefly congregate.

Fumigants are also used to control certain fruit tree pests, such as scales. One of the most important applications of this method is the fumigation of citrus trees for Red Scale, Wax Scale, or other species of scale that may be infesting the trees. Calcium cyanide or sodium cyanide, in dust or other form, is the fumigant used. This gives off a gas known as hydrocyanic acid gas. Trees should only be fumigated during non-windy weather and at night. It is very essential that the foliage of the trees should be dry. If this fact is not observed considerable damage of foliage will follow, resulting in the shedding of leaves and fruit. Calcium cyanide is a very powerful poison and should be handled with extreme care. Avoid the inhalation of the gas, which is also very deadly. This treatment must only be undertaken by competent and careful operators.

It is of the greatest importance that whatever method of control is applied, it should be done at the earliest and most opportune time after the pest has appeared. The damage caused is thus kept at a minimum.

An insect is also more readily controlled if it is dealt with in the younger stages or before it has had time to reach plague form. In conjunction with the use of sprays, dusts or fumigation there must always be orchard sanitation. This means the keeping down of all weeds and rubbish, thorough cultivation and drainage of the soil and the maintenance of the trees in a healthy state of growth by the application of suitable manures.

The question of biological control must not be over-looked.

Parasites and predators, commonly known as beneficial insects, should be recognised by growers. To be able to discriminate between beneficial and destructive insects will prevent the ignorant destruction of many of our most useful insects, such destruction further unbalancing nature in favour of the destructive species.

In the attached tables and diagrams the standard spraying, dusting, and fumigation materials for chewing and sucking insects and the way in which they may be combined are given. To make use of the diagram the first consideration is the kind of fruit to be sprayed: next, the pests to be combatted and, finally the choice of the spray materials. It may be found necessary to combine spraying ingredients to deal with more than one species of insect or fungus disease present upon the tree. In this case the diagram submitted should be carefully consulted.

Combined sprays in which even only slight chemical changes take place among the ingredients should be used as soon as combined and not be held over for any length of time. Trees should never be fumigated or sprayed when out of condition or stressed through lack of available moisture. Do not spray during intense heat.

Reference is made in the tables to "red" and "white" oils, which are the terms commonly used to designate the miscible oils used in dormant spraying, and the emulsions of highly refined oils for summer spraying. The "red" or miscible oil consists of a lubricating oil in which the soap emulsifier is dissolved, and the oil is not actually emulsified until water is added. The "white" oil is a light, refined oil, already emulsified with soap and water, and is used on trees in foliage because it has not the same tendency to burn as the lubricating oils. It will be noticed in the table of compatible and incompatible sprays, that lead arsenate cannot be mixed with oil, the reason being that water-soluble arsenic is produced, causing burning. In U.S.A., however, these two sprays are frequently applied in combination, ½lb. to 1lb. of high grade hydrated lime being added to each 100 gallons of spray to prevent burning.

Nicotine sulphate is more familiar to some under the name "Black leaf 40," but it must be remembered that this is merely a trade name for one brand of nicotine sulphate, and that there are other brands on the market. Nicotine sulphate should always be used in combination with soap, unless it is already mixed with oil, Bordeaux, lime-sulphur, washing soda, or some other alkali, because if it is mixed with water alone, it does not give off all its nicotine, and is, therefore, less effective.

For tobacco wash, the formula recommended by the New South Wales Department of Agriculture is 12lbs. waste tobacco, 6ozs. washing soda, 30 gallons of water. Steep for 36 hours and strain through sacking. It will be noticed in the table that tobacco wash containing soda must not be mixed with lead arsenate or lime-sulphur. If a wash is to be mixed with lime-sulphur, use the formula 20lbs. waste tobacco, 50 gallons cold water, 4½lbs. quicklime. Slake the lime with a small quantity of water heated nearly to boiling, and add the mixture to the balance of the 50 gallons of water. Finally the tobacco waste is added, and the mixture allowed to stand for 36 hours and strained as before.

In using oil and lime-sulphur sprays, it is customary not to apply the one within a month of the other, and this is a wise precaution. Whenever any doubt exists as to the possible results of applying a combination of sprays, or two sprays in succession, consult both the chart and the table, and if these do not supply the information, apply to the Department. Do not act in the dark, as immense damage may result.

It will probably be found also, that the treatment for various insect and fungus pests clashes or overlaps. In this case a little ingenuity should solve the problem, but here also a good rule is, when in doubt, consult the Department.

In the compilation of this article, free use has been made of information from other publications, mainly "Spraying," issued by the Department of Agriculture of New South Wales, and various U.S.A. Agricultural Department bulletins. The chart and table of compatible and incompatible sprays were adapted from those appearing in "Spraying."

CARE OF SPRAYING MACHINES.

In order to obtain satisfactory results from spraying, the spraying machines must be kept in good working order. One of the most frequent causes of trouble with the spraying machines is carelessness in leaving them dirty or partially filled with spray material.

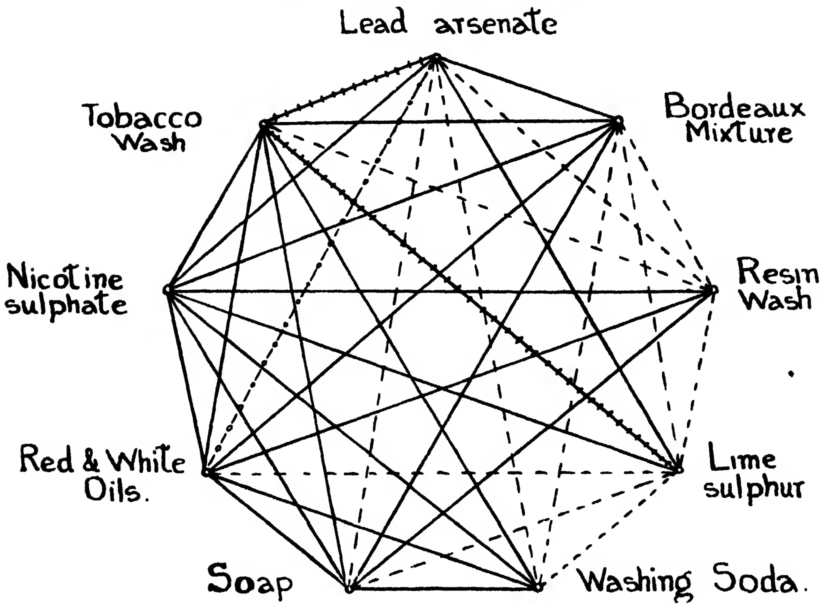
The machine should always be thoroughly washed with clean water at the end of each day's work. Clean water should also be pumped through all hose and nozzles. If this is done much trouble will be avoided. A supply of spare parts should always be on hand.

TABLE OF COMPATIBLE AND INCOMPATIBLE SPRAYS.

Spray.	May be mixed with :	Must not be mixed with :
Bordeaux Mixture	Lead arsenate, Paris green, nicotine sulphate, tobacco wash, red and white oils, soap*	Lime sulphur, resin wash, washing soda,
Burgundy Mixture .	Nicotine sulphate	Lead arsenate, Paris green, lime sulphur, resin wash, soap, washing soda.
Lead arsenate	Bordeaux, lime sulphur, atomic sulphur, nicotine sulphate, tobacco wash (if it contains no soda), white oils	Resin wash, soap, washing soda, red oils, tobacco wash (if it contains soda).
Lime sulphur	Lead arsenate, nicotine sulphate, tobacco wash (made with lime, not soda)	Bordeaux, Burgundy, resin wash, soap, washing soda, red and white oils.
Paris Green	Bordeaux, nicotine sulphate	Resin wash, soap, washing soda.
Resin wash	Kerosene emulsion, nicotine sulphate, red and white oils, soap	Bordeaux, Burgundy, lead arsenate, lime-sulphur, Paris green, tobacco wash.
Soap	Bordeaux, tobacco wash, nicotine sulphate, resin wash, washing soda, red and white oils	Burgundy, lime-sulphur, lead arsenate, Paris green.
Atomic sulphur	Lead arsenate, Paris green, lime-sulphur.	
Red and white oils ...	Nicotine sulphate, resin wash, Bordeaux, soap, lead arsenate (with white oils only)	Lime-sulphur, lead arsenate (can be mixed with white oils).
Nicotine sulphate	Bordeaux, Burgundy, lead arsenate, lime-sulphur, red and white oils, resin wash, soap, washing soda	
Tobacco wash	Lead arsenate (if wash contains no soda), lime-sulphur (when wash prepared with quicklime), soap, nicotine sulphate, washing soda, Bordeaux, red and white oils	Lead arsenate (if wash contains soda), Paris green, lime-sulphur (if wash contains soda).
Washing soda	Red and white oils, soap, nicotine sulphate, tobacco wash	Bordeaux, Burgundy, lime-sulphur, lead arsenate, Paris green.

* Mixing oil and Bordeaux leads to some loss of efficiency in the insecticidal action of the oil.

SPRAY COMPATIBILITY CHART.



Sprays connected by a black line may be mixed together.

Sprays connected by a dotted line *must not* be mixed together.

—o—o—o— Lead arsenate may be mixed with white oils, but not with red oils.

—ı—ı—ı— Lead arsenate or lime-sulphur may be mixed with tobacco wash only if the wash contains no soda.

SPRAYING CALENDAR FOR FRUIT TREES.

Pest.	Treatment	Time of Application.	Remarks.
Codlin Moth	(1) Spray with arsenate of lead powder 2½lbs., white oil 1 gallon, water 100 gallons (2) Trap with molasses 1 part, water 9 parts, placed in glass jars hung in trees (3) Scrape loose bark from trunks, destroy infested fruit daily by boiling, use hessian bands on trunks	Calyx spray—After petals fall and before calyx closes Five cover sprays at about following intervals:— 1st—10-12 days after calyx spray 2nd—14 days later 3rd—6 weeks after 2nd 4th—10-12 days later 5th—14 days after 4th	The white oil is not used in the calyx spray, but should be included in the cover sprays. The cover sprays are applied at the time indicated by the catch in the moth traps.
Bryobia Mite ...	(1) Spray, red oil 1 in 20 ... ... (2) Summer spray, white oil 1 in 100 (3) Destroy all prunings by burning	Just before buds swell 3 weeks after hatching of first mites (usually October). Similar spraying 3 weeks later (November)	Nicotine sulphate 1½ pints to 100 gals. can be added to the white oil spray if desired.
Apple Curculio ...	(1) Apply bait round bases of trees at rate of 15lbs. per acre. Bait 1lb. Sodium Fluoride, 9lbs. minced dried apple (2) Spray with lead arsenate powder 1oz., water 1 gallon	First baiting—Last week in November. Second baiting—third week in February Same times as bait (see above)	The first baiting alone may be sufficient. If not, apply the second bait. Use the lead arsenate spray only when the trees are not fruiting.
Plague thrips ...	(1) Spray with winter oil ... ... (2) Dust with pyrethrum powder 12 parts, flowers of sulphur 8 parts (Recommendation of Mr. J. W. Evans, M.A., Officer of C.S.I.R.)	Early in dormant period During blossoming ...	To advance blossoming dates. This dust has a repellent effect for several days.

APPLE.

Pest.	Treatment.	Time of application.	Remarks.
Apple and Pear Aphis	Nicotine sulphate 1¼ pints, household soap 4 lbs., water to make 100 gallons; or nicotine sulphate 1¼ pints, white oil 1 gallon, water to make 100 gallons	When Aphids observed	Apply with coarse nozzle and high pressure.
Fruit-fly	(1) Gather fallen and infested fruits every 24 hours, destroying those infested, by boiling (2) Trap with Clensel 1 part, water 29 parts; or pollard 8 ozs., borax 8 ozs., arsenate of soda ¼ oz., water 1 gallon; renew lure every 7 days (3) Bait with foliage bait: 1 gallon fruit syrup preferably from oranges, 4 lbs molasses, 2½ ozs lead arsenate powder, water to make 4 gallons. Bait the foliage every 7 days. Ready-made bait on market	Control measures must be carried on from a period of six weeks before ripening of fruit, until all fruit is removed from the tree	(1) is compulsory whenever fruit-fly is present. (2) is compulsory for orchards of from 1 to 200 trees, at least two traps per tree being used. Orchardists having more than 200 trees must use either (2) or (3).
Termites	(1) Bore a hole into the gallery of the termites, pour in 1 oz Carbon-bi-sulphide and plug with wet clay; or puff Paris green into the gallery (2) Bait: 4½lbs molasses, 1½lbs. sugar, ¼lb arsenate of soda, ½-pint water. Mix and heat molasses and sugar, dissolve arsenate of soda in ½-pint of boiling water and stir into molasses and sugar. Put liberal dose of mixture between two pieces of pine and bury close to infested trees Fumigation With Carbon-bi-sulphide, or Paradichloro-benzine	.. ..	Very poisonous. When roots affected.
Woolly aphis ..	(1) Red oil spray, 1 in 15 . .. (2) Spray with nicotine sulphate 1¼ pints, household soap 4 lbs., water to make 100 gallons	During dormant period Whenever aphis appears in numbers in the summer	The woolly aphis is well controlled by a parasite *Aphelinus mali*, which should be established if it is not already present.
San José Scale, Mussel Scale, Greedy Scale	(1) Spray with red oil 1 in 15, or lime sulphur (winter strength) ... (2) Destroy all prunings by fire	During dormant period During late dormant period	
Loopers, Climbing Cut-worms, and other Caterpillers	(1) Arsenate of lead powder 1½ lbs., water 50 gallons (2) Plough early to turn in weeds which harbour Cut-worms	When Caterpillars present	
Bud, Bark and Leaf-eating Beetles, Grass-hoppers, etc.	Spray with arsenate of lead powder 3 lbs., water 50 gallons	When pests observed ..	Do not use this spray later than December while the fruit is on the tree

PEAR.

Codlin Moth	*See* under Apple.		
Bryobia Mite .	*See* under Apple.		
Apple Curculio ..	*See* under Apple.		
Plague Thrips ..	*See* under Apple		
San José Scale; Greedy Scale	*See* under Apple.		
Black Scale; Vine Scale	(1) Spray with red oil or lime sulphur (winter strength) (2) Destroy all prunings by burning	During dormant period	
Looper and other Caterpillars	*See* under Apple.		
Bud, Bark and Leaf-eating Beetles, Grass-hoppers, etc.	*See* under Apple.		

PEAR—*continued.*

Pest.	Treatment.	Time of application.	Remarks.
Apple and Pear Aphis	*See* under Apple.		
Fruit-fly	*See* under Apple.		
Termites	*See* under Apple.		
Pear Slug ..	Spray with lead arsenate powder 1½ lbs., water 50 gallons	When slug present	
Pear-leaf Blister Mite	(1) Red oil spray ... ... (2) Spray with lime sulphur 1 in 75 (32 Beaume') to 1 in 65 (28 Beaume') plus calcium caseinate spreader	In early dormant period At bud pinking stage	 Spreader is necessary to penetrate the opening buds.

PEACH AND NECTARINE.

Pest.	Treatment.	Time of application.	Remarks.
Bryobia Mite .	*See* under Apple.		
Fruit-fly ...	*See* under Apple		
San José Scale, Greedy Scale	*See* under Apple.		
Vine Scale, Black Scale	*See* under Pear		
Termites .	*See* under Apple.		
Climbing Cut-worm and other Caterpillars	*See* under Apple		
Green Peach Aphis	Treat as for Apple and Pear Aphis, under Apple	When Aphis observed	
Black Peach Aphis .	(1) Remove 2in. or 3in. of soil from round tree, apply liberal dressing of tobacco dust and replace soil (2) Spray with nicotine sulphate 1½ pints, household soap 4 lbs., water to make 100 gallons	During dormant period In spring, when first aphids appear on shoots	This treatment is directed at the root-feeding forms of the Aphis.
Rutherglen Bug ..	(1) Keep orchard and adjoining areas, if possible, free from weeds in spring (2) Use smoke smudges .. .. (3) Dust with equal parts calcium cyanide dust and flowers of sulphur (4) Spray with good contact spray, *e.g.* turps 5 pints, Sunlight soap 12 lbs., water to make 100 gallons	... ... When bugs are at tacking fruit	Careful observation of surrounding grass paddocks in spring and early summer reveals presence of young bugs, and danger of swarming may be estimated. If large numbers are found, burn off the grass as soon as possible.
Bush Bug	(1) Shake off trees and destroy .. (2) Spray with Sunlight soap and turps, as under Rutherglen Bug	When bugs observed	
Bud, Bark, and Leaf-eating Beetles, Grasshoppers, etc.	*See* under Apple.		

APRICOT.

Pest.	Treatment.	Time of application.	Remarks.
Fruit-fly	*See* under Apple.		
San José Scale Greedy Scale	*See* under Apple.		
Vine Scale, Black Scale	*See* under Pear.		
Termites	*See* under Apple.		
Rutherglen Bug ...	*See* under Peach.		
Bush Bug	*See* under Peach.		
Climbing Cut-worms, and other Caterpillars	*See* under Apple.		

APRICOT—*continued.*

Pest.	Treatment.	Time of application.	Remarks.
Leaf-eating Beetles, Grasshoppers, etc.	*See* under Apple.		

QUINCES.

Codlin Moth	*See* under Apple.		
Fruit-fly	*See* under Apple		
San José Scale, Greedy Scale	*See* under Apple.		
Black Scale	*See* under Pear.		
Soft Brown Scale ...	(1) Spray with red oil .. .. (2) Destroy prunings by burning	During dormant period	
Termites	*See* under Apple.		
Bud, Bark, and Leaf-eating Beetles, Grasshoppers, etc.	*See* under Apple		
Leaf-eating Caterpillars	*See* under Apple,.		

PLUM.

San José Scale, Greedy Scale	*See* under Apple.		
Black Scale, Vine Scale	*See* under Apple.		
Fruit-fly ..	*See* under Apple.		
Bryobia Mite ..	*See* under Apple.		
Termite	*See* under Apple.		
Bud, bark and leaf-eating Beetles, Grasshoppers, etc.	*See* under Apple.		
Leaf-eating caterpillars	*See* under Apple.		

CHERRY.

San José Scale, Greedy Scale	*See* under Apple.		
Pear Slug	*See* under Pear.		
Cherry Borer .	Place in bore a plug of cotton-wool soaked in carbon-bi-sulphide, and plug with damp clay	When boring observed	Do not bring lights near carbon-bi-sulphide, as it is inflammable and explosive.
Rutherglen Bug ...	*See* under Peach.		

LOQUAT.

Fruit-fly	*See* under Apple.		
Tussock-moth Caterpillars	Spray with lead arsenate powder, 2lbs., water, 100 gallons	When caterpillars seen on leaves	
Greedy Scale ...	*See* under Apple.		
Soft Brown Scale ...	Spray with red oil	During dormant period	

ALMOND.

Pest.	Treatment.	Time of application.	Remarks.
Bryobia Mite	*See* under Apple		
Red Spider	(1) Spray with red oil. ... .. (2) Spray with white oil 1–100, or lime-sulphur 1–50	During dormancy Two or three weeks after first appearance in spring or early summer	A second spring spraying is advisable 10 days after the first.
Greedy Scale, San José Scale	*See* under Apple.		
Black Scale, Vine Scale	*See* under Pear		
Cherry Borer ..	*See* under Cherry.		

FIG.

Pest.	Treatment.	Time of application.	Remarks.
Greedy Scale ...	*See* under Apple.		
Soft Brown Scale ..	*See* under Quince		
Red Scale . .	(1) Sprap with red oil .. ... (2) Destroy all prunings by burning	During dormant period	
Fruit-fly . ..	*See* under Apple.		

GRAPE.

Pest.	Treatment.	Time of application.	Remarks.
Vine Scale .	*See* under Pear.		
Hawk Moth Caterpiller	(1) Spray with lead arsenate powder. 3lbs., water, 100 gallons (2) Destroy by hand.	When observed.	
Vine Foliage Thrips	Spray with nicotine sulphate 1¼ pints, household soap 4lbs., water to make 100 gallons	When Thrips present	
Climbing Cutworm, and other Caterpillars	(1) Spray with lead arsenate powder 3lbs., water 100 gallons (2) Turn in weeds	For Climbing Cutworm on grapes, first spray when Cutworms first observed, one or more cover sprays at 10 day intervals As early as possible	
Rutherglen Bug . .	*See* under Apple.		
Leaf-eating Beetles, Grasshoppers, etc	*See* under Apple		

CITRUS.

Pest.	Treatment.	Time of application.	Remarks.
White Wax Scale ...	Fumigate with calcium cyanide, or spray with white oil, or 1lb. washing soda to 1 gallon water	March and April. First spray early January, second spray end of February or early March	Soda ash may be used at half the strength recommended for washing soda
Red Scale, Soft Brown Scale, Black Scale	Fumigate with calcium cyanide, or Spray with white oil	January, February, March, April February, March, April	Two sprayings may be necessary.
Black Orange Aphis ..	Spray with nicotine sulphate 1¼ pints, household soap 4lbs., water to make 100 gallons	When aphis observed in autumn and spring	Two or three sprayings at intervals of about two days will probably be necessary.
Fruit-fly	*See* under Apple.		
Orange Rust Mite ...	Spray with lime-sulphur 1 in 75, or Dust with flowers of sulphur	When russeting of fruit noticed Usually March and April	One good application should suffice.
Leaf-eating Caterpillars	*See* under Apple.		
Leaf and blossom-eating Beetles, Grasshoppers etc.	Spray with lead arsenate powder 3lbs. to 50 gallons	When observed.	

OAT VARIETY TRIALS IN THE SOUTH-WEST.

M. CULLITY, Agricultural Adviser, Dairy Branch.

The results of two further Oat Variety Trials conducted in the South-West are here recorded.

At Donnybrook and Balingup the experiments were conducted on the properties of Messrs. B. Langridge and G. E. White, results of which were as follow:—

B. Langridge, Donnybrook.

Soil: Dark clay loam.

Cultivation: Ploughed single furrow, disc cultivated and harrowed in June.

Rate of Seeding: 2 bushels per acre.

Fertiliser: 180 lb. superphosphate per acre.

Date of Sowing: 7th July, 1932. Variety "Lachlan" sown 26th July, 1932.

The yields were as follow:—

Variety.	Yield.				Percentage Yield Hay.
	tons	cwts.	qrs.	lbs.	
Algerian	1	8	2	19	100
Guyra	1	7	2	25	96
Burt's Early	1	7	1	23	95
Mulga	1	9	2	14	103
Lachlan *	1	4	2	11	85

* Included in Experiment by the farmer, 1932.

The "Mulga" oats gave the best results under the existing conditions, being about 6 inches taller than the "Burt's Early." Neither of these two varieties tillered greatly.

The "Guyra" was slower in running up from the stool than the "Mulga" or "Burt's Early," but it was slightly ahead of the "Algerian" and tillered fairly well.

All the plots were very even in growth, the "Guyra" being a little shorter in the straw.

G. E. White, Balingup.

Soil: Very sandy loam.

Cultivation: Ploughed in June, cultivated and harrowed to seed bed.

Rate of Seeding: 2 bushels per acre.

Fertiliser: 1 bag superphosphate per acre.

Date of Sowing: 5th June, 1932.

The yields were as follow:—

Variety.	Yield.				Percentage Yield Hay.
	tons	cwts.	qrs.	lb.	
Algerian	1	12	1	23	100
Guyra	2	10	0	26	146
Burt's Early	1	19	1	10	122
Mulga	2	2	0	15	131

The growth was very even throughout, but the date of sowing was apparently late for "Algerian."

The average of the 25 trials conducted throughout the South-West are shown in the following table:—

Variety.	Yield. Average 70 plots—25 trials.				Percentage Yield Hay.
	tons	cwts.	qrs.	lb.	
Algerian	2	8	0	7	100
Guyra	2	3	3	15	91
Lachlan	2	2	0	7	87
Burt's Early	1	15	3	1	74
Mulga	1	15	2	13	74

RELATIVE FOOD VALUES.

RELATIVE VALUES OF CONCENTRATES.

PERTH, JUNE 1ST, 1933.

Foodstuff.	Cost.	Cost per 100 lbs.	Starch equivalent per 100 lbs.	Digestible Protein per 100 lbs.	Cost per lb. of Starch equivalent.	Cost per lb. of Digestible Protein.
		s. d.			d.	d.
Wheat ...	3s. 3d. per bushel of 60 lbs.	5 5	73	9·0	0·89	7·2
Oats ...	2s. 3d. per bushel of 40 lbs.	5 7½	63	7·0	1·07	9·0
Bran ...	£5 12s. 6d. per ton	5 0	48	13·0	1·25	4·7
Pollard ...	£5 17s. 6d. per ton	5 3	61	13·5	1·03	4·7
Linseed Meal	14s. 6d. per 100lbs.	14 6	72	25·5	2·42	7·0
Meat Meal	15s. 6d. per 100lbs.	15 6	92	60·0	2·00	3·1
Peas ...	5s. per bushel of 60 lbs.	8 4	74	19·0	1·35	5·3

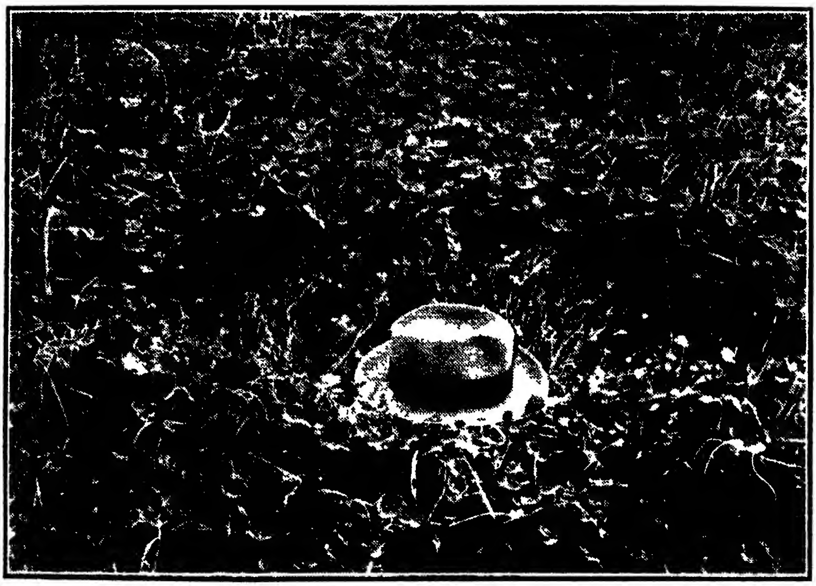
KIKUYU GRASS.

H. G. ELLIOTT, Agricultural Adviser, Dairy Branch.

Kikuyu Grass (*Pennisetum clandestinum Pilga*) was introduced into Australia from South Africa and is a native of the Belgian Congo. It is now well past its experimental stages in this State, and is grown extensively as a pasture plant and to some extent as a lawn grass.

In Western Australia, as well as the other States of the Commonwealth, Kikuyu has not exhibited any signs of forming seed, although flowering has been recorded; consequently it has to be propagated by means of "roots" or cuttings.

Kikuyu Grass is a perennial running grass with branching leafy stems which form a dense turf similar to couch grass. The leaves are flat and spreading. It has numerous stout rhizomes nearly as thick as a lead pencil, and by means of these, and the above ground runners, a single plant will soon cover an area of several square yards. On rich soil, in the presence of sufficient moisture, it will grow to the height of three feet, but the stems at the base become very decumbent, thereby forming a dense mat, so that the lower leaves soon die.



Subterranean Clover and Kikuyu Grass growing at Harvey under irrigation.
(*Photo. by G. N. Lowe.*)

This grass, being a vigorous grower, naturally draws heavily on the available plant food in the soil, adequate fertilisation, therefore, being necessary to maintain vigorous growth. Being a tropical grass, the growing period is during the summer months, provided moisture is present. It remains green during the winter and starts to grow vigorously with the advent of the warm weather in the spring. Its drought resistant qualities are equal to if not better than those of most of the perennial grasses.

An important characteristic of Kikuyu is its capability of growing in conjunction with clovers. In New Zealand good results are obtained by surface sowing a mixture of White and Red Clover and Lotus major after the Kikuyu cuttings have been set. In South Africa, Kikuyu and White Clover are described as "ideal pasture," and it is found that any clover will grow in conjunction with Kikuyu Grass. Experience in Western Australia also shows that clovers will grow in conjunction with Kikuyu. Where it has been planted on old Subterranean pastures in the irrigation areas and elsewhere, the two are now growing together with excellent results, as illustrated in the above photograph. The nutritive value of Kikuyu and clover is about the same as that of lucerne, but lucerne would not give the same bulk.

Kikuyu Grass is naturally suited for pastures. It is a perennial, and spreads quickly by means of above and below ground runners. The above ground runners carry large quantities of leaf, thereby providing a bulk of fodder. The grass grows very rapidly and has the power of rooting at every joint, forming a dense turf which will stand heavy tramping and severe "rooting" by pigs. This turf-forming habit is a most important factor from a grazing point of view. Tussocky grasses become tramped and eaten out more readily than "turf" grasses; also they do not cover the ground completely, consequently bare patches occur, allowing weeds to become established which ultimately smother the more valuable pasture plants.

In Western Australia Kikuyu has adapted itself readily to most of our soils under varying climatic conditions. It can be found growing on sand, loam, clay loam, gravelly sand, and heavy clay soil with excellent results, but appears to thrive best on rich summer moist soils or where irrigation can be supplemented. It is not a swamp grass, but has been observed in this State to withstand the effects of flooding for five months, and in November, when the water receded, green shoots immediately made their appearance, producing an abundance of feed.

As Kikuyu does not produce seed in the South-West of this State, the only method of propagation is by means of cuttings. The crowns of well rooted plants are divided, and the rooted running stems and "roots" are cut so that for planting the piece is not more than six inches long. If large areas are to be planted, the land should be ploughed and brought into good condition. At planting time plough again, and in every third or fourth furrow set the cuttings at a distance of about 2½ to 3 feet apart in the furrow. At the rate 5,000 to 6,000 sets are required per acre. When setting, great care should be taken, as only about two-thirds of the cutting should be covered by the soil. Where small areas are to be planted, or the land is too rough for ploughing, the cuttings are hoed in. Care should be taken to firm the soil around each piece as it is set.

The best time of planting is during the spring or early summer months, but it can be planted in the autumn as late as the end of April. A cheap method of establishment is to plant the cuttings between rows of maize after the last inter-cultivation has taken place.

At the time of planting a dressing of 1½ to 2 cwts. of superphosphate is advisable, and topdressing should be carried out in the autumn with superphosphate and ammonia No. 3 at the rate of 1½ cwts. per acre, with a further application of 1½ cwts. of superphosphate in the spring.

With bad management, after about four years Kikuyu is likely to become sod bound, and then its yield of top growth will decrease. When this occurs ploughing is necessary. The proper use of fertilisers, efficient grazing, and the use of disc harrows or paspalum renovators annually will prevent this sod-bound condition occurring.

Kikuyu Grass makes a very dense growth, being at first erect, but, when the height of 12 to 18 inches is reached, it lodges as the stems at the base become very decumbent, consequently it is not very well suited for hay-making. Hay made from this grass is palatable and highly nutritious but has not a sweet odour, and is difficult to cure on account of the thick stems.

Kikuyu can be regarded as a most palatable grass, but there are some grasses which are more so. Palatability tests carried out with cows in New South Wales showed that Kikuyu is more palatable than Cocksfoot, Timothy, and Rhodes Grass, while the Hungarian Brome was more palatable than the Kikuyu. Similar experiments were carried out in South Africa which showed that *Phalaris tuberosa* was more palatable than Kikuyu Grass mixed with clover which, however, was second on the list.

In New South Wales excellent results are obtained with Kikuyu for controlling Bracken Fern. The following method is adopted:—

The land is well worked prior to planting in the spring; the fern fronds cut in the early spring, and the grass planted in rows 3 feet apart with 3 feet between the cuttings. Fertiliser used, $1\frac{1}{2}$ cwts. superphosphate per acre. The Kikuyu makes rapid headway—by the following spring a mat of grass has formed and the fern is gradually choked out.

The following table shows the analyses of Kikuyu Grass compared with Sudan Grass and Japanese Millet:—

PERCENTAGE COMPOSITION.

	Moisture.	Crude Protein.	Crude Fat.	Carbohydrate.	Crude Fibre.	Ash.	Authority.
Kikuyu (18 inches high)	7.6	17·4	1 1	42·4	22·1	9·4	W. Aus. Gov. Anal.
Kikuyu	...	15·3	2·2	36·3	33·1	13·0	Wollongbar, N.S.W.
Kikuyu	...	14·5	2·0	31·4	34·7	14·4	Grafton, N.S.W.
Sudan Grass (in flower)	6·7	10·9	1·7	48·3	24·5	8·0	Jeffries, Sth. Aus.
Sudan Grass 2 feet high)	...	16·4	3·7	37·4	25·8	16·7	Guthrie, N.S.W.
Japanese Millet (Ears peeping)	...	13·3	2·3	40·2	29·7	14·4	Guthrie, N.S.W.

Conclusions.

1. As Kikuyu does not seed in the South-West of Western Australia, the means of propagation is by cuttings, or division of the crown.
2. It is not affected by frost in the dairying districts.
3. It grows on almost any class of soil but thrives best on fertile soil.
4. As it does not seed, it should be easily kept in check.
5. It should be valuable in Bracken Fern country.
6. It is a valuable pasture and lawn grass but unsuited for hay purposes.
7. It appears naturally adapted to grow with legumes.
8. Spring and early summer planting are recommended.

HERD TESTING.

THE OFFICIAL AUSTRALIAN PURE BRED DAIRY CATTLE PRODUCTION TESTING SCHEME.

Conducted by Dairy Branch. Department of Agriculture. 1932-33.

Incomplete—the final results for the year ending 30th June, 1933, will be published in the September Journal.

Name of Cow.	Breed	Date of Birth.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk Last day of Test	Weight of Milk for period.	Average Test.	Butter Fat.	Owner.	Sire.
MATURE COWS (OVER 5 YEARS OLD)—STANDARD 350 LBS BUTTER FAT											
						lb.	lb.	%	lb.		
Koojan Bonnie Jean	Guernsey	28-3-26	1612	23-4-32	273	19	9,042	6·04	543·88	A. W. Padbury	Robin of Nundorah
Pansy 5th of the Hill	A.I.S. ...	2-2-25	15729	18-5-32	273	25½	13,591	4·00	543·16	D. Bevan	Crescent of the Hill
Brookvale Noble Queen ...	Jersey ...	24-6-26	24895	6-7-32	273	19	9,942	4·80	480·33	G. F. Combs	Noble Lad of Roelands
Glanavon Jenny	A.I.S. ...	1926	Vol. 8	2-11-31	273	23	10,449	4·68	470·37	D. Bevan	(foundation)
Kurrawong Kitty 8th	do. ...	6-8-26	16030	12-2-32	273	36	10,293	4·58	459·12	W. G. Burges ...	Premier of Kurrawong
Kurrawong Kathleen 5th ...	do. ...	13-12-25	16027	24-6-32	273	26	11,328	4·10	456·77	W. G. Burges	do.
Matilda 7th of Berry	do. ...	15-1-24	14074	31-1-32	273	30	9,960	4·53	452·65	W. G. Burges ..	Rutland of Darbalara
Koojan Bonnie Elizabeth ...	Guernsey	23-3-27	1899	7-4-32	273	19	7,452	5·9	443·05	A. W. Padbury ..	Robin of Nundorah
Hope 3rd of the Hill ...	A.I.S. ..	6-1-25	15710	20-7-32	273	19	10,932	4·0	440·12	W. G. Burges	Crescent of the Hill
Koojan Wavelet	Guernsey..	7-8-26	1619	3-10-31	273	23	8,364	5·2	436·88	A. W. Padbury ..	Robin of Nundorah
Yanmah Pearl 2nd	A.I.S. ...	15-4-25	1 M.S.	16-7-32	273	21¼	9,769	4·5	436·84	J. C. Phillips ...	Rostellan Knight of Yanmah
Grassvale Golden Cream 2nd ...	Jersey ...	23-4-26	24926	19-7-32	273	16½	7,474	5·62	421·67	R. H. Rose	Rye Duke of Glen Iris
Koojan Dame	Guernsey	18-6-24	1252	16-6-32	273	26	10,428	4·1	416·72	Denmark State Farm	Robin of Nundorah
Koojan Mordern Lady 2nd ...	do. ...	11-8-22	918	27-12-31	273	20¼	8,431	4·88	409·95	A. W. Padbury ...	Gay Lad's Golden Dawn
Koojan Lady Betty 4th ...	do. ...	22-5-26	1616	11-2-32	273	16	8,913	4·56	408·36	A. W. Padbury ..	Robin of Nundorah
Boo-Peep of Greenmount ...	Jersey ..	24-6-25	20902	30-7-32	273	21¼	7,894	5·10	403·87	A. J. B. Strempel ...	Werribee Starbright King
Moorlands April	do. ...	3-9-26	23687	16-5-32	273	14¼	7,663	5·20	399·17	P. Rose	Colonel of Melrose
Kurrawong Royal Lady ...	A.I.S. ...	6-4-25	16049	21-1-32	273	32	10,035	3·98	398·49	W. G. Burges ...	Count Hughes
Claremont Pentland Blossom 6th	do. ...	2-7-27	17926	13-7-32	273	18	9,864	4·0	397·03	Hospital for Insane ...	Telyarup Prince of Claremont
Grassvale Cream Duchess ...	Jersey ...	24-9-23	17531	29-5-32	273	15	7,770	5·03	390·97	R. H. Rose	Rye Duke of Glen Iris
Numbawarra Lulu	A.I.S. ..	21-9-26	4022	22-3-32	273	19	9,927	3·86	385·70	W. G. Burges ..	Fairy's Jock of Fairfield
Brookvale Noble Lily	Jersey ..	19-8-26	24894	7-7-32	273	16	7,803	4·80	373·81	G. F. Combs ...	Noble Lad of Roelands
Greenmount Charming Bells 2nd	do. ...	12-3-26	23708	9-6-32	273	18	6,684	5·48	367·48	A. J. B. Strempel ..	Cheer-up of Hamel-Lea
Wooroloo Redwings	A.I.S. .	1-11-23	15148	8-5-32	273	23	8,709	4·20	364·90	Wooroloo Sanatorium Farm	Commercial of Blackheath
Colmyn's Lady	Jersey ...	31-1-27	23667	4-8-32	273	12½	7,137	5·20	364·64	C. H. Ironmonger ...	Roeland's Milord
Capel Lass	do. ..	1-8-25	24906	8-5-32	273	19	7,892	4·6	363·55	B. W. Prowse ...	Brown Fern of Glen Iris
Wooroloo Wing Wing	A.I.S. ...	2-5-26	Vol. 8	25-5-32	273	18	8,206	4·26	349·57	Wooroloo Sanatorium Farm	Eclipse of Wooroloo
Denmark Anne	Guernsey ...	2-3-23	1164	27-6-32	273	14	7,287	4·80	343·25	Denmark Stud Farm	Linwood of Wollongbar
Moorlands Bebe	Jersey ...	21-4-27	24912	31-5-32	240	9	7,365	4·60	339·27	P. Rose	Grafter of Melrose
Dahlia 4th of Raleigh	A.I.S. ...	2-12-26	17470	1-8-32	210	24	9,770	3·40	334·65	D. Bevan ...	Union Jack of Raleigh
Favourite 3rd of Roelands ...	Jersey ...	23-2-25	16856	5-8-32	273	14¼	7,418	4·60	334·09	B. W. Prowse ...	Noble Duke of Glen Iris
Moorlands Ada	do. ...	25-5-26	23679	23-4-32	240	15	6,165	5·4	329·73	P. Rose	Colonel of Melrose
Glanavon Daisy	A.I.S. ...	1926	Vol. 8	2-2-32	273	27	10,401	3·25	325·92	D. Bevan	(foundation)
Colleen of Rosewood	Guernsey...	30-1-22	819	22-12-31	273	19	6,537	4·90	324·36	Denmark Stud Farm...	Archer of Nundorah
Carnation of Minathorpe. ...	A.I.S. ...	6-3-26	...	29-11-31	273	21	6,993	4·8	311·84	R. Bee	Bruce of Sunnyvale

Moorlands Hazel	Jersey ...	29-7-25	20891	16-7-32	240	13½	6,615	4·67	308·37	P. Rose	Hope of Moorlands
Denmark Rosa 2nd	Guernsey	6-2-27	1793	11-4-32	273	17½	6,397	4·57	305·20	Denmark Stud Farm...	Rose Chief of Wollongbar
Wollongbar Dinah 2nd ...	do. ...	13-2-32	832	7-12-31	273	12	6,486	4·58	295 20	Denmark Stud Farm..	Judge of Wollongbar
Spurfield Air Girl 2nd	do. ...	22-4-24	1048	4-11-31	273	15	5,325	5·38	285·53	Muresk Agricultural College	Milton's Steadfast
Mayfield Sunol 2nd	A.I.S.... ...	-11-20	12820	23-11-31	273	21	7 683	3·65	280·85	D. Bevan	Masher of Mayfield
Mokine Empire Lily 9th ...	Jersey ...	25-5-26	...	7-1-32	273	10	5,100	5·40	271·59	T. H. Wilding ...	Mokine The Hood
Betty 2nd of Wollongbar ...	Guernsey...	4-7-26	1571	15-5-32	273	13	5,394	5·00	267·47	Muresk Agricultural College	Bounty of Wollongbar
Dahlia 5th of Berry	A.I.S. ...	20-2-24	15545	2-5-32	150	36	6,780	.	250·38	D. Bevan	Mirth of Berry
Blanche 6th of Claremont ..	do. ..	6-1-26	17910	4-11-31	180	13	6,180	3·98	242 10	Claremont Hospital for Insane	Telyarup Prince of Claremont
Moorlands Lydia	Jersey ...	22-12-24	19107	12-5-32	120	40½	5,197	..	241 39	P. Rose	Top Notch of Roelands
Muresk Lily	Guernsey..	16-2-27	1801	6-4-32	273	11½	4,339	5·27	228·68	Muresk Agricultural College	Triumph of Wollongbar
Springmead Lady Osram ..	Jersey ..	2-11-23	18295	18-12-31	273	14	5,202	4·27	222 13	Sabina Vale Stud Farm	Springmead Osram
Denmark Red Rose 2nd ..	Guernsey ..	31-10-26	1792	10-12-31	210	14½	3,975	5·07	202·44	Denmark Stud Farm	Rose Chief of Wollongbar
Yanmah Snowdrop	A.I.S. .	15-5-27	...	29-5-32	150	20½	4,665	...	183·06	J. C. Phillips ...	Rostellan Knight of Yanmah
Daphne 7th of the Hill ..	do. ..	15-5-26	15697	22-10-32	30	57	1,710	.	74·88	W. G. Burges ..	Crescent of the Hill

COWS OVER 4 YEARS 6 RONTHS AND UNDER 5 YEARS—STANDARD 330 LBS. BUTTER FAT

Sally of the Hill	A.I.S. ...	8-10-27	15741	20-6-32	273	29	12,207	4 00	497 89	W. G. Burges ...	Crescent of the Hill
Gold 11th of Raleigh	do. ...	16-10-27	17597	25-6-32	273	23	11,094	4·07	447 77	D. Bevan	Royal Standard at Darbalara
Koojan Ida	Guernsey	3-2-27	1930	15-9-31	273	23	7,403	5·40	403 29	A. Padbury	Robin of Nundorah
Do.	do. ...	3-2-27	1930	15-9-31	365	23	9,609	5 66	544 13	A. Padbury	do. do.
Picture 8th of Raleigh ...	A.I.S. ...	22-4-27	17524	5-12-31	273	31	10,698	3 80	388·74	D. Bevan	Union Jack of Raleigh
Moorlands Blot	Guernsey	27-8-27	24917	6-5-32	240	14½	6,720	5·10	343·32	P. Rose	Zenith of Moorlands
Moorlands Blur	Jersey ...	8-9-27	24918	14-5-32	240	13½	6,540	4 86	316·05	P Rose	Grafter of Melrose
Glanavon's Famous Star ...	A.I.S. ..	30-8 27	2382	24-6 32	210	9	7 065	3·90	278·67	D. Bevan . .	Premier of Blackheath

COWS OVER 4 YEARS AND UNDER 4 YEARS 6 MONTHS—STANDARD 310 LBS. BUTTER FAT.

Karawarra Plum 3rd	A.I.S. ..	27-4-28	1261	10-6-32	273	32	10 956	3·80	422·67	W. G. Burges ...	Sailor of Karawarra
Star of Claremont	do. ..	15-2-27	17928	9-10-31	273	8½	10,480	3·90	409·64	Claremont Hospital for Insane	Telyarup Prince of Claremont
Juadive Belvedere	Jersey ..	12-5-28	28180	29-6-32	273	15	7,320	5·56	406·27	Miss Hancock ...	Mokine Hero
Brushgrove Tulip 2nd	A.I.S. .	3-7-27	18109	5-12-31	273	41½	10,579	3·77	379·41	E. C. Melville ..	Ardee of the Hill
Greenmount Bonnie Lass ...	Jersey ..	23-3-28	28237	19-5-32	273	18	6,474	5·59	360·27	A J. B. Strempel ...	Werribee Starbright King
Banyule Velveteen 12th ...	do. ...	11-9-27	24474	14-10-31	273	20	6,600	5·39	355·10	Sabina Vale Stud Farm	Wotton Airman
Claremont Pentland Blossom 7th	A.I.S. ...	21-4-28	2415	14-7-32	273	17	8,286	4·16	345·93	Claremont Hospital for Insane	Telyarup Prince of Claremont
Folly of Aorangi	do. ..	18-6-27	17064	20-9-31	240	21½	9,570	3·58	343·10	E C. Melville ...	General Maud of Aorangi
Moorlands Chloe	Jersey .	2-5-28	28214	17-6 32	210	17½	6,180	5·61	340·59	P. Rose	Colonel of Melrose
Clarendon Eyre Betty	do. ...	28-4-28	Vol. 20	26-5-32	273	21½	7,794	4·30	338·08	Sabina Vale Stud Farm	Clarendon Eyre Eminents Achievement
Springpark Dora	do. ..	6-3-28	24900	10-4-32	273	14½	5,868	5·44	319·76	C. H. Ironmonger ...	PrinceMarinora of G.
Mokine Empire Lily 12th ..	do. ..	30-11-27	...	23-12-32	273	11	4,503	6·95	312 86	T. H. Wilding ...	Noble's Best of G. Hill
Muresk Rose	Guernsey	9-5-28	2156	2-8-32	273	12	5,931	5·10	307·14	Muresk Agricultural College	Triumph of Wollongbar
Claremont Poppy 2nd	A.I.S ...	17-1-28	2420	13-6-32	273	16	6,883	4·40	302 53	Claremont Hospital for Insane	Telyarup Prince of Claremont
Muresk Pansy	Guernsey...	10-6-27	1802	6-11-31	273	18	5,529	5·48	301·73	Muresk Agricultural College	Triumph of Wollongbar

HERD TESTING—*continued.*

Name of Cow.	Breed.	Date of Birth.	Herd Book No.	Date of Calving	No. of Days in Test.	Weight of Milk Last day of Test	Weight of Milk for period.	Average Test	Butter Fat.	Owner	Sire
COWS OVER 4 YEARS AND UNDER 4 YEARS 6 MONTHS—STANDARD 310 LBS. BUTTER FAT—*continued.*											
						lb	lb	%	lb.		
Valerie of Aorangi	A.I.S. ..	14-7-27	17086	20-9-31	240	10½	6,915	4·33	298·89	E. C. Melville .	General Maud of A.
Moorlands Cherry	Jersey ...	2-5-28	28213	12-6-32	240	8½	5,910	5·00	295·26	P. Rose .	Colonel of Melrose
Moorlands Beckie	do. ..	11-8-27	24913	9-2-32	240	21½	5,460	5·4	294·33	P. Rose .	Moorlands Zenith
Minnamurra Confetti	Guernsey	20-7-27	1859	27-10-31	273	16	4,443	5·75	253·35	Muresk Agricultural College	Judge of Wollongbar
Grassvale Lady Fowler 9th ...	Jersey ...	17-6-28	...	12-9-32	210	12	4,680	.	239·67	R. H. Rose	Mokine Christopher Columbus
Springmead Island Rose ...	do. ..	9-3-28	27214	7-7-32	273	7¼	5,032	4·4	223·13	Sabina Vale Stud Farm	Springmead Islander
Violo 2nd of Wangara	A.I.S. ...	23-8-27	17885	26-10-31	210	8	3,990	4·26	170·34	A. E. Grant . ..	Limelight of Darbalara
Tipperary Matilda	do. ...	2-4-28	17901	1-5-32	120	25½	3,675		147·90	A. E. Grant ..	Villiers of Darbalara
Juadine Sparkle 2nd	Jersey ...	4-6-28	...	24-7-32	60	37	2,070	..	99·60	Miss Hancock ..	Mokine Hero
COWS OVER 3½ YEARS AND UNDER 4 YEARS—STANDARD 290 LBS. BUTTER FAT											
Yallah Farm Maggie 2nd ...	A.I.S. ..	30-8-28	1272	22-7-32	273	31	13,233	3·90	508·87	W. G. Burges ..	Fussy's Favour of Park View
Karridale Queen	Guernsey	27-11-28	2754	9-8-32	273	25	9,360	5·30	493·95	G. E. Scott	Minnamurra Oliver Twist
Newry Lady Freeda	do. ...	13-9-28	2719	19-6-32	273	19	7,302	6·02	433·80	G. E. Scott	Koojan Mack
East View Gwen 2nd ...	A.I.S. ...	1-9-28	18337	15-5-32	273	27½	12,967	3·31	430·77	A. E. Grant	Marinor of Greyleigh
Karridale Lady Betty	Guernsey...	19-9-28	2331	10-6-32	273	20½	7,381	5·20	386·94	G. E. Scott . ..	Minnamurra Oliver Twist
Karawarra Champion 2nd ...	A.I.S. ...	6-5-28	1253	28-3-32	273	30	9,750	3·98	384·80	W. G. Burges ..	Sailor of Karawarra
Cherry 2nd of Claremont ...	do. ...	8-2-28	2394	8-10-31	273	19	8,637	4·40	378·85	Claremont Hospital for Insane	Telyarup Prince of Claremont
Koojan Polly	Guernsey...	13-12-28	2665	13-9-32	273	17	6,961	5·40	377·46	A. W. Padbury ...	Koojan Golden Governor
Mokine Twylish Lass	Jersey ...	29-11-28	34845	21-6-32	273	11	5,628	6·40	359·52	T. H. Wilding ..	The Valley Twylish Fox
Denmark Rose Pearl 3rd ...	Guernsey...	20-11-27	1798	25-10-31	273	14	6,027	5·95	357·57	Denmark Stud Farm	Rose Chief of Wollongbar
Mavis 2nd of Claremont ...	A.I.S. ...	3-3-28	2411	28-10-31	273	25	8,025	4·00	321·79	Claremont Hospital for Insane	Telyarup Prince of Claremont
Moorlands Clara	Jersey .	18-8-28	28215	10-6-32	240	13	6,075	5·10	308·46	P. Rose ...	Grafter of Melrose
Moorlands Ceres	do. ...	17-5-28	28211	3-5-32	240	10½	5,535	5·50	307·23	P. Rose . ..	Colonel of Melrose
Muresk Daisy	Guernsey	16-6-28	2155	9-5-32	273	18	6,764	4·44	299·46	Muresk Agricultural College	Triumph of Wollongbar
Moorlands Camilla	do. ...	4-7-28	28207	13-6-32	240	12½	6,025	4·84	290·67	P. Rose	Colonel of Melrose
Moorlands Corona	Jersey ...	15-11-28	28223	28-6-32	210	16	5,220	5·55	279·66	P. Rose	Romeo of Melrose
Moorlands Celia	do. ...	17-5-28	28210	3-5-32	240	11½	5,475	5·00	277·78	P. Rose ...	Colonel of Melrose
Colmyn's Princess Marinora ...	do. ...	15-5-28	24897	2-3-32	273	16½	4,749	5·7	271·17	C. H. Ironmonger ...	Prince Marinora of Grass Vale
Springmead Fern	do. ...	5-3-28	27213	21-11-31	273	7½	5,392	4·88	263·83	Sabina Vale Stud Farm	Springmead Islander
Lady Jean 4th of Jerrara Park	A.I.S. ...	30-11-27	13012	19-10-31	210	22	7,020	3·73	261·66	E. C. Melville ...	Tulip's Hero of Hill View
Minathorpe Carnation 4th ...	do. ...	2-8-28	2475	25-2-32	273	17	6,216	4·19	260·26	R. Bee	Collier of Darbalara
Wooroloo Gem 3rd	do. ...	25-12-28	2519	17-9-32	180	17	5,055	4·30	217·47	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Telyarup Milkmaid 2nd ...	do. ...	15-10-28	2505	3-5-32	240	7½	5,475	3·48	190·29	A. E. Grant	Baron of Darbalara

Tipperary Virginia	do. ..	7-2-28	17905	6-4-32	150	24	3,915		160·47	A. E. Grant	Villiers of Darbalara
Glanavon Sunbeam	do. ..	2-2-29	2368	6-10-32	60	28¼	1,770		69·69	D. Bevan	Pine Creek of Dunbar
Liberton Patricia	do. ...	1-1-29	2441	8-8-32	30	37½	1,125		36·45	A. E. Grant	Limit of East View

OVER 3 YEARS OLD AND UNDER 3½ YEARS.—STANDARD 270 LBS. BUTTER FAT.

Banyule Silvermine 55th ...	Jersey ...	2-8-28	25,473	22-11-31	273	20½	7,726	5·65	435·66	Sabina Vale Stud Farm	Air Lord of Banyule
Bella 3rd of the Hill	A.I.S. ...	13-5-28	15,690	27-10-31	273	26	9,168	4·23	381·48	W. G. Burges .	Crescent of the Hill
Capel Favourite	Jersey	1-3-29	31211	17-5-32	273	18¼	6,745	5·13	346·18	B. W. Prowse .	Bracken Fern of Roelands
Grassvale Sweet Maggie 2nd ...	do. ...	27-3-29	28229	17-7-32	273	13½	6,345	5·18	326·80	R. H. Rose . .	Starbright S.D. of G.I.
Koojan Bonnie Buttercup ...	Guernsey .	18-10-28	2230	5-4-32	273	11	5,958	5·20	311·66	A. W. Padbury .	Koojan Golden Governor
Koojan Daffodil	do ...	4-10-28	2231	4-12-31	273	14½	5,293	5·90	311·42	A. W. Padbury ..	Koojan Golden Governor
Flash of East View ...	A.I.S. ..	4-10-28	18331	7-12-31	273	20	8,145	3·80	305·44	A. E. Grant .. .	Marinor of Greyleigh
Glenoshea Ada	Jersey ..	23-8-28	24492	(Vict.)	273	19½	6,433	4·69	300·36	Sabina Vale Stud Farm	Burnside Mooltan
Blanche 6th of Minathorpe	A.I.S. .	13-6-28	17937	8-12-31	273	21	6,723	4·50	294·54	R. Bee	Collier of Darbalara
Greenmount Gipsy Lass ..	Jersey .	6-3-29	28239	4-6-32	273	12½	4,747	6·12	290·12	A. J. B. Strempel ..	Werribee Starbright King
Moorlands Doris	do. .	14-5-29	31235	1-6-32	210	15	5,925	4·80	285·03	P. Rose . .	Moorlands Romeo
Greenmount Gipsy Maid	do. .	8-3-29	28240	2-5-32	273	12	4,716	5·71	238·41	A. J. B. Strempel .	Werribee Starlight King
Telyarup Thelma 2nd	A.I.S. .	22-11-28	2506	5-5-32	240	8¾	6,090	4·43	266·22	A. E. Grant ..	Baron of Darbalara
Greenmount Snowflake ..	Jersey ...	30-3-29	28242	15-5-32	273	11	5,073	5·29	264·47	A. J. B. Strempel .	Werribee Starbright King
Moorlands Colleen ..	do. ..	1-12-28	28219	15-2-32	273	17	5,631	4·49	251·80	P. Rose	Moorlands Plato
Tipperary Royal Lady . ..	A.I.S. .	13-11-29	2377	17-11-31	273	9	4,677	4·3	203·90	R. Bee	Tipperary Melba's Re-Echo
Belle 6th of Claremont ...	do. .	29-9-28	2336	21-1-32	180	12½	4,785	.	199·79	Claremont Hospital for Insane	Clinker of Claremont
Colmyns Borona Rye	Jersey ..	23-4-29	31188	23-7-32	240	7½	3,875		172·28	C. H. Ironmonger .	Rye Duke of Glen Iris
Colmyns Rye Cream	do ...	16-11-28	28193	7-2-31	150	6½	1,530	5·40	88·20	C. H. Ironmonger .	Rye Duke of Glen Iris

COWS OVER 2½ YEARS AND UNDER 3 YEARS.—STANDARD 250 LBS. BUTTER FAT.

Koojan Polly	Guernsey...	13-12-28	2665	21-10-31	273	17	7,041	5·18	363·17	A. W. Padbury	Koojan Golden Governor
Banyule Silvermine 66th ..	Jersey .	10-9-29	.	29-3-32	273	17½	6,217	5·79	358·70	Sabina Vale Stud Farm	Milkmaid Chief of Banyule
Claremont Belle 9th	A.I.S. ...	25-8-29	2388	4-5-32	273	23	8,259	4·10	340·03	Claremont Hospital for Insane	Claremont Evan
Nooka Lass	Jersey .	14-1-29	28187	4-1-32	273	24	6,582	5·06	330·43	S. P. Herbert .	Jessie's King of Sarnia
New Park Sally 9th	A.I.S. ..	30-4-29	1873	20-2-32	273	22	8,751	3·68	319·48	W. G. Burges ..	Ruler of Greyleigh
Moorlands Dazzle	Jersey .	14-9-27	31225	18-5-32	240	13¼	5,565	5·35	297·66	P. Rose .	Moorlands Raleigh
Clarendon Eyre Romany Lass 2nd	do. ...	23-5-29	33948	4-4-32	273	15¾	5,911	5·00	296·64	Sabina Vale Stud Farm	Eminent V.C.
Grassvale Golden Cream 3rd ...	do ...	28-8-29	.	22-7-32	273	12	5,586	5·2	289·62	R. H. Rose	Choice Goods of Garden Hill
Brookvale Toppers Mena	do. ...	3-8-29	31176	17-6-32	273	12	5,286	5·4	285·42	G. F. Combs ..	Belletaire L. Belltopper
New Park Amy 7th	A.I.S. ...	14-6-29	1865	15-2-32	273	20	7,065	4·00	280·11	W. G. Burges ..	Ruler of Greyleigh
Moorlands Duchess	Jersey ...	11-7-29	31289	4-6-32	210	15	5,610	5·00	277·35	P. Rose . ..	Moorlands Romeo
Moorlands Dream	do. ...	1-9-29	31237	13-6-32	240	10	5,250	5·18	271·86	P. Rose . . .	Melrose Romeo
Greenmount Buttercup ..	do. ...	26-5-29	28238	21-5-32	273	14½	5,053	5·22	261·31	A. J. B. Strempel ..	Werribee Starbright King
New Park Mystery 4th ..	A.I.S. .	8-6-29	1870	12-2-32	273	26	7,023	3·73	260·38	W. G. Burges ..	Ruler of Greyleigh
Grassvale Choice Maid	Jersey ...	10-10-29	34812	5-9-32	273	18	4,674	5·4	253·69	R. H. Rose	Choice Goods of Garden Hill
Denmark Red Rose 3rd ...	Guernsey...	6-3-29	2521	28-12-31	273	15½	4,366	5·8	253·56	Denmark Stud Farm	Rose Chief of Wollongbar
Moorlands Dingle	Jersey ...	9-7-29	31231	7-7-32	210	14½	5,430	4·66	251·91	P. Rose	Melrose Raleigh
Brookvale Topper's Lulu	do. .	15-7-29	31175	13-6-32	273	9½	4,438	5·6	249·91	G. F. Combs ..	Bellefaire L. Belltopper
Snowdrop 27th of Kurrawang..	A.I.S. ...	5-5-29	1380	27-11-31	273	21	6,063	4·1	246·21	W. G. Burges .	Standard of Cosy Camp
Muresk Petunia	Guernsey...	29-11-29	2796	1-5-32	273	11	4,413	5·4	236·90	Muresk Agricultural College	Triump of Wollongbar
Brookvale Topper's Success ...	Jersey ...	10-8-29	31177	13-7-32	273	12	4,651	5·0	235·53	G. F. Combs ...	Bellefaire L. Belltopper

HERD TESTING—*continued.*

Name of Cow.	Breed.	Date of Birth.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk Last day of Test.	Weight of Milk for period.	Average Test.	Butter Fat.	Owner.	Sire.
COWS (OVER 2½ YEARS AND UNDER 3 YEARS OLD)—STANDARD 250 LBS. BUTTER FAT—*continued*											
						lb.	lb.	%	lb.		
Colmyn Ladybird	Jersey ...	24-9-29	31190	11-6-32	273	9	4,517	5·21	234·59	C. H. Ironmonger .	Rye Duke of Glen Iris
Moorlands Dulcie	do. ...	17-5-29	31241	12-2-32	210	22	3,915	5·67	226·17	P. Rose	Moorlands Raleigh
Wyuna Goldie	Guernsey...	12-10-29	2670	3-5-32	273	11	4,293	4·99	213·37	Muresk Agricultural College	Nundorah Buccaneer
Colmyns Marinora Rye ...	Jersey ...	13-9-29	31191	7-4-32	273	9	3,627	5·56	200·42	C. H. Ironmonger ...	Rye Duke of Glen Iris
Capel Centenary Girl	do. ...	15-10-29	34781	9-8-32	240	7	4,330		200·26	B. W. Prowse ..	Bracken Fern of Roeland
Muresk Dahlia	Guernsey ..	6-6-29	2526	9-5-32	273	10	3,405	5·50	187·67	Muresk Agricultural College	Triumph of Wollongbar
Wooroloo Milkmaid	A.I.S. ...	3-2-29	2520	20-10-31	273	6	3,813	4·65	176·84	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Claremont Lupin 6th	do. ...	19-12-29	2408	13-8-32	60	26	1,635	...	64·14	Claremont Hospital for Insane	Claremont Evan
Karridale Zonia	Guernsey...	28-10-29	2842	20-9-32	30	19	570	..	26·70	E. D. P. Hayes ..	Minnamurra Betty's Prince
COWS (UNDER 2½ YEARS OLD)—STANDARD 230 LBS. BUTTER FAT.											
Koojan Tiddlewinks	do. ...	24-9-30	3546	7-9-32	273	21	6,363	5·70	360·39	A. W. Padbury ...	Homestead Ace
Greenmount Starlight Marinora	Jersey ...	31-5-30	34841	7-4-32	273	18	5,994	5·90	353·07	A. J. B. Strempel ...	Werribee Starbright Butter King
Nooka Twylish Madiera ...	do. ...	16-7-30	34744	7-8-32	273	22	6,696	5·00	343·40	S. P. Herbert ...	Spring Park Prince Ragtime
Claremont Mabel 3rd	A.I.S. ...	1-11-29	2409	4-5-32	273	22	7,596	4·30	326·56	Claremont Hospital for Insane	Sunnyvale Searchlight
Wooroloo Red Rose 2nd ...	do. ...	25-6-29	2522	12-12-31	273	22	6,896	4·64	320·59	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Nooka Ragtime Rose	Jersey ...	7-4-30	34743	26-3-32	273	16	4,788	6·26	310·08	S. P. Herbert ...	Spring Park Prince Ragtime
Brookfields Lady Lilian ...	Guernsey...	28-11-29	2720	11-5-32	273	19	5,997	5·05	303·15	G. E. Scott	Koojan Lord Berkley
Cookolabbai Jewel	do. ..	18-9-25	3771	19-12-31	273	23	6,069	5·20	301·58	A. W. Padbury ...	Cookalabbai Pride 2nd
Moorlands Elsie	Jersey ..	12-6-30	34803	17-7-32	210	11	5,430	5·18	279·84	P. Rose	Melrose Romeo
Wooroloo Lass	A.I.S. ...	30-12-29	..	29-3-32	273	25	6,945	4·00	279·42	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Springhurst Belladonna... ...	Jersey ...	12-2-30	33644	20-4-32	273	16½	5,544	5·03	276·55	Sabina Vale Stud Farm	Starbright Prince of Glen Iris
Grangelea Pretty Primrose ..	do. ...	31-10-29	33038	14-10-31	273	17	4,836	5·70	273·68	Sabina Vale Stud Farm	Banyule Airo
Ilginup Agnes	A.I.S. ...	2-12-29	5192	2-5-32	240	23	8,305	3·26	271·14	E. C. Melville ...	Sally's Lad of New Park
Springhust Countess 5th ...	Jersey ...	29-3-30	33647	27-4-32	273	14	4,992	5·41	270·72	Sabina Vale Stud Farm	Valient Prince of Glen Iris
Melba 3rd of Tipperary ...	A.I.S ...	11-10-29	2358	16-11-31	273	23	6,279	4·25	267·04	R. Bee	Melba's Re-Echo of Tipperary
Berrington Soprano 2nd ...	Jersey ...	5-10-29	...	19-12-31	273	12¼	4,312	6·20	266·61	Sabina Vale Stud Farm	Banyule Superstrain
Ilginup Aimee	A.I.S. ...	4-12-29	5193	4-4-32	273	12	6,341	4·19	265·34	E. C. Melville ...	Greyleigh's Father Xmas.
Ocolup Gladies 2nd	Jersey ...	1-5-30	...	7-7-32	273	10½	5,386	4·70	263·39	B. W. Prowse ...	Fairy's Duke of Grass Vale
Minathorpe Treasure 5th ...	A.I.S. ...	20-10-29	2477	21-2-32	273	19	5,592	4·36	261·63	R. Bee	Collier of Darbalara
Ilginup Adele	do. ...	27-11-29	5191	13-3-32	273	9	5,235	5·10	260·75	E. C. Melville ...	Victory of Aorangi
Moorlands Ella	Jersey ...	5-3-30	34802	16-7-32	210	11	4,410	5·82	256·17	P. Rose	Melrose Romeo
Wyuna Lady Dawn	Guernsey...	12-11-29	2472	3-2-32	273	20½	5,596	4·53	253·68	Denmark Stud Farm	Nundorah Prosper

Grassvale Lady Fowler 11th ...	Jersey ...	20-6-30	34817	8-8-32	273	14	4,542	5·60	253·19	R. H. Rose ...	Choice Goods of Garden Hill
Springhurst Melilot 4th ...	do. ...	2-4-30	33648	21-3-32	273	12½	4,037	6·22	249·12	Sabina Vale Stud Farm	Valient Prince of Glen Iris
Ilginup Annette	A.I.S. ...	10-12-29	5194	12-4-32	273	15	6,118	4·08	245·30	E. C. Melville ..	Victory of Aorangi
Grassvale Cream Goods ...	Jersey ...	28-8-29	34814	7-12-31	273	17	5,136	4·90	245·13	R. H. Rose	Choice Goods of Garden Hill
Minnamurra Prairie Bell ...	Guernsey...	2-11-29	2619	17-1-32	273	19	4,917	4·84	241·61	Muresk Agricultural College	Minnamurra Rose
Wyuna Jean	do. ...	8-9-29	2471	2-3-32	273	15½	5,146	4·80	241·29	Muresk Agricultural College	Nundorah Buccaneer
Moorlands Elaine	Jersey ..	13-4-30	34800	1-7-32	210	13	4,755	4·90	233·34	P. Rose	Melrose Romeo
Priscilla of Tipperary	A.I.S. ...	9-9-29	2359	17-11-31	273	17	5,061	4·60	230·49	R. Bee	Villiers of Darbalara
Staghorn Northlark's Matilda ...	Jersey ...	9-8-30	34787	19-6-32	273	11½	4,294	5·1	218·92	Robinson Bros. ...	Staghorn Northlark's Masterpiece
Colmyns Cellene Rye	do. ...	10-8-30	34751	16-8-32	273	10½	4,146	5·4	218·63	C. H. Ironmonger ..	Fairy's Duke of Grassvale
Minnamurra Currency Lass ...	Guernsey...	27-9-29	2606	27-3-32	273	13	4,779	4·55	217·63	Muresk Agricultural College	Caramana Favour
Lonswood Ruth 5th	Jersey ...	13-10-30	34785	18-3-32	273	6½	3,919	5·35	213·87	B. W. Prowse .	Hamel Cea Fancy's Dapper
Spurfield Eastern Jewel ...	Guernsey..	1-12-29	2390	4-4-32	273	12	4,581	4·65	213·33	Muresk Agricultural College	Spurfield Eastern King
Glenavon Trixie	A.I.S. ...	21-3-30	5112	11-4-32	273	13	5,469	3·86	211·02	D. Bevan	Pine Creek Dunbar
Staghorn Northern Belle ...	Jersey ...	10-9-30	34786	22-8-32	273	11	3,588	5·80	209·88	Robinson Bros. ..	Staghorn Northlark's Masterpiece
Woodendale Poppy	do. ...	6-4-30	34717	23-5-32	273	9	4,572	4·50	207·82	F. P. Attwell	Mokine Lady's Chief
Wollongbar Rosebud 2nd ..	Guernsey..	10-1-30	2789	14-3-32	273	6	4,833	4·24	204·98	Denmark Stud Farm	Wollongbar Satisfaction
Springhurst Sparaxis	Jersey ...	19-3-30	33650	29-4-32	273	12	3,981	5·10	203·88	Sabina Vale Stud Farm	Glen Iris Vigilant
Spurfield Desdemona	Guernsey...	29-1-30	2764	25-2-31	273	15	4,050	5·07	203·17	Denmark Stud Farm	Spurfield Eastern King
Minnamurra Sun Lady ...	do ...	25-2-30	2811	11-3-32	273	11	3,783	5·09	192·62	Muresk Agricultural College	Minnamurra Justice
Minnamurra Eleanor	do. ..	13-8-29	2607	14-10-31	273	16	4,203	4·44	186·56	Muresk Agricultural College	Caramana Favour
Wollongbar Haughty	do. ...	30-11-29	2492	27-2-32	273	13	3,399	5·00	170·13	Denmark Stud Farm	Wollongbar Hopeful
Glanavon Fraulein	A.I.S. ...	19-3-30	2363	10-4-32	273	10½	4,246	3·98	166·46	D. Bevan ...	Pine Creek Dunbar
Colmyn Rodora	Jersey ...	10-3-30	31192	18-3-32	273	5¾	2,086	5·68	140·58	C. H. Ironmonger ..	Rye Duke of Glen Iris
Woodendale Buttercup ...	do. ...	24-9-30	34715	17-5-32	273	5½	2,911	4·70	136·93	F. P. Atwell ...	Mokine Lady's Chief
Nooka Ragtime Lassie	do. ...	13-10-30	34742	1-6-32	150	17¼	2,550	.	120·12	S. P. Herbert ...	Spring Park Prince Ragtime
Woodendale Ettie	do. ...	11-4-30	..	20-6-32	90	12¼	1,260	...	63·09	F. P. Atwell ...	Mokine Lady's Chief
Aberbechan Snowdrop	A.I.S. ...	9-3-30	2440	5-4-32	60	26¾	1,515	...	62·16	A. E. Grant	Raleigh Regent
Colmyn's Jessica...	Jersey ...	6-12-29	31189	5-4-32	90	12½	1,185	.	60·60	C. H. Ironmonger ...	Rye Duke of Glen Iris
Glanavon Vida	A.I.S. ...	29-6-30	5145	6-7-32	60	22	1,305	...	57·39	A. E. Grant	Raleigh Regent

BLOW-FLY DRESSINGS AND BRANDING FLUIDS.

THE DETRIMENTAL EFFECT OF TAR CONTAINING PREPARATIONS ON THE WOOL.

H. McCALLUM, Sheep and Wool Inspector, and W. McC. JOHNSON, Cadet.

For many years a widespread campaign has been waged against the use of tar and similar materials, or of compounds containing them, as branding fluids or as dressings for blow-fly strike. In spite of this, however, their use has not been entirely discarded.

During the recent wool-selling season the management of one of the wool warehouses stated that portions of some of the station clips forwarded for sale were stained by some mixture which would not scour out. This was considered to be due to the fact that station owners had treated some of their sheep with the preparation in an endeavour to combat the blow-fly trouble. Two samples, one of the greasy wool and the other of scoured, drawn from one of these clips, were forwarded to this branch of the Department. The staining mixture in the greasy sample was analysed by the Government Analyst, who reported that the use of some creosote preparation, in all probability one containing wood creosote and arsenious oxide, was responsible for the staining of the wool. It was stated that creosote of both the wood tar and coal tar varieties contains large amounts of phenols, which darken by oxidation, on exposure to the light and air, and that the presence of tarry matter in the cruder creosote oils, which are often used in these preparations, would increase the staining and make it more difficult to remove. The stain was certainly very resistant to the ordinary methods of scouring, for although the second sample had been scoured twice under ordinary conditions, it was still of a colour ranging from dark to light brown.

In addition to the staining of the wool, pigments such as tar may seriously damage the fibre itself, as wool fibres are easily affected by strong chemical substances. Some merely render the wool harsh, whilst others seriously weaken it. Again, such substances, either by coating the fibre or removing or altering the surface scales, may prevent the wool properly taking dyes.

It is obvious, therefore, that the value of the wool if so contaminated will be very greatly reduced.

Whether it was a proprietary mixture or a station preparation used in the instance quoted is not yet known, but it was considered advisable to warn all wool-growers to be extremely cautious in their choice of branding fluids and of blow-fly dressings and, above all, to refrain from using tar or pitch for these purposes.

In giving this advice it is regrettable that no suitable formula for a sheep-marking fluid can be recommended as giving entirely satisfactory results for, under Western Australian conditions at least, no fluid officially tested has been beyond criticism from both the grower's and the manufacturer's points of view.

To meet requirements, a branding mixture must be permanent as a brand and yet easy to remove in the scouring process. The problem of evolving such a fluid has been engaging the attention of various research institutions throughout the wool-growing countries of the world, notably the Wool Industries Research Association of Leeds, England. This association recently contributed a note on the subject to the Journal of the British Ministry of Agriculture, which stated that it had recommended two branding fluids, one of which was suitable for use under

British and similar conditions, and the other for use in the Dominions; both of these fluids had been subjected to exposure trials. The Dominions fluid, of the following composition:—

	Parts by weight.
Wool fat	30
Resin	20
Carnauba wax	3
Kieselguhr	18
Ignited iron oxide	6
Emco spirit	to consistency

was tested in almost all the Dominions, and it was stated that the detailed reports indicated the success of the fluid from both the grower's and the manufacturer's standpoints.

In Australia, however, the mixture has been criticised on the ground of illegibility, but it is stated by a writer in the Journal of the Council for Scientific and Industrial Research that the criticism is not always warranted, for the Council carried out a very successful experiment with a number of shorn comeback wethers branded with a mixture made up according to the Association formula. After branding the sheep were continuously exposed to the weather and although at the time of writing ten months had elapsed, the brands were still plainly visible.

In Western Australia the fluid was tested in many different parts of the State, but the results were not nearly so convincing. The mixture, which had been prepared by the Association itself, was made up in three different colours, viz., red, blue and green, but, although in the case of the tests carried out at the Muresk Agricultural College the brand remained clear in outline from shearing to shearing, and on opening up the wool the colours themselves were plainly visible, in most cases the brands faded rapidly with the beginning of the winter while, owing to the accumulation of dust and grease in the tip, the colours were indecipherable after a period of about two months. Therefore, although this fluid is suitable to the manufacturer, for the Research Association states that the brand is always removed in a normal commercial scour and examinations of fabrics manufactured from wool so treated have revealed satisfactory results, it is not under all conditions suitable from the grower's point of view. We have, however, drawn attention to its composition because it is at least known that no detrimental effects can arise from its use.

In the case of blow-fly strike, the position is not nearly so unsatisfactory, for there are many dressings commonly recommended which are thoroughly efficacious, and yet neither stain the wool nor destroy any natural properties of the fibre. Recently the joint Blow-fly Committee appointed by the Council for Scientific and Industrial Research issued its first report* on the Sheep Blow-fly Problem. This report devotes a section to dressings, in the course of which it summarises the properties of a good dressing as follow:—

(a) It should kill or remove all maggots without injury to the sheep or the wool;

(b) It should be non-irritating to the skin or wounds;

(c) it should dry up the struck area and be soothing to the wound;

(d) it should act as a repellant to flies, and so prevent re-strikes for a reasonable period.

* This report may be obtained from the Department at the price of 1s. 6d. per copy. It contains all the latest available information concerning the many phases of this problem and is of great practical value to sheep-farmers.

In the light of these requirements, the report mentions the following dressings recommended by the Department of Agriculture, New South Wales:—

(a) 5 per cent. watery solution of zinc sulphate;

(b) 4 per cent. phenol crystals in whale oil;

(c) 5 per cent. watery solution of monsol.

The report states:—"All of these are of distinct value for the routine dressing of sheep under station conditions, and are adequate, except when re-strikes are frequent. Unfortunately, none has any marked repellent property, though the drying action of (a) and (c) is a valuable preventive. Some degree of repellent action may be obtained by the addition of 5 per cent. carbon tetrachloride to the phenol and whale oil dressing. Though the dressings recommended have the limitations mentioned, they constitute the most recent knowledge available, and this Committee concurs in these recommendations."

No criticisms of the value of proprietary dressings or branding fluids can be given here, as very few tests have been carried out by this Department. There are, of course, a number of these on the market and the farmer must, by test, decide their value for himself. In the case of branding fluids we might add that, although very many have been tested by various institutions connected with the woollen industry both in Australia and abroad, none have been reported as giving entirely satisfactory results. In fact, the Research Association fluid is the only one which, under some conditions at least, has proved suitable to both sections of the industry.

HORTICULTURAL NOTES.

GEO. W. WICKENS, Superintendent of Horticulture.

When this Journal is printed the last of the deciduous fruit crop for season 1932-33 will have been gathered, the major portion sold, and orchardists busy preparing by careful husbandry for next season's production.

Though the season now nearly ended has not been one of the most favourable it has, nevertheless, proved far from being a failure either in quantites produced or prices received.

Export has been up to the average in quantity, over half a million cases being shipped before the end of May with more still to go. The actual number of cases to the 26th May (latest figures available at time of writing) amounted to 569,528, which comprises as the principal lines 477,512 apples, 46,976 pears, and 44,219 grapes. The quality of the greater portion of apples and pears submitted for export was above the average, apples particularly being solid in texture, of good colour, juicy and fine flavour. Grapes were a bit below the average in quality, the severe heat wave in February having made its influence felt to the disadvantage of many varieties. The variety worst affected was Muscat Gordo Blanco, one that is not looked upon as being a good export kind but which, in its season, is prime favourite on the local market as fresh fruit and provides in a dried condition the lexia of commerce. After the heat wave many bunches never properly ripened and losses were severe.

Currants cropped well and the quality was good. The yield of dried product will be in the vicinity of 1,600 tons, and of these a little over 1,000 tons have been shipped overseas. Sultana production has been over the average, about 400 tons being processed at the dried fruit sheds.

As mentioned above, growers' attention must now be turned to preparing for next season's crop—pruning, ploughing, spraying, cultivating (when not carried out in April)—all needing attention between now and early summer.

With reference to pruning I would like to say a word of warning to those who intend leaving apple trees, which are in their sixth to eighth years, unpruned with the object of hastening fruit bearing habits. The idea of leaving the leaders and horizontally placed laterals unpruned is quite a good one if the trees are strong and growing vigorously, but when this is done the dense growths in the centres of the trees must be thinned out or the desired cropping habit will not be attained owing to the buds in the heavily shaded portions of the trees failing to produce flowers.

Regarding spraying, it has been pleasing to find that fruit submitted for export this season has been very free from San Jose scale, and it is hoped that growers will continue the good work during this winter and spray thoroughly. As a matter of fact, it must be admitted by anyone who has first-hand knowledge in combatting the scale mentioned that it is not a difficult pest to control; two good sprayings in winter, one with oil and one with lime sulphur, and it is a difficult job to find live scale in the following summer, but if allowed to increase and multiply at its own sweet will the insects become so numerous that the trees may be devitalised and commence dying at the terminals.

In infested areas fruit fly has been more in evidence during the season just ended than for a number of years past, and all citrus and loquat growers should carefully watch for signs of infestation. In winter time baiting as a means of control cannot be relied upon, so trapping should be continuously carried out and all infested fruit boiled.

Orange aphis will make its appearance towards the end of winter, and where the insects are sufficiently numerous to damage young growths and blossoms spraying must be attended to. Tobacco extract and soap is an old and reliable spray, but very good results have been obtained in recent years by the use of white oils.

That Western Australia has added another to her list of successes in combating pests and diseases has been proved this season, no trace of apple scab, Venturia inequalis, having been discovered either in those orchards which were infested three seasons ago or in any other.

Codlin Moth also has not been seen for three seasons, a circumstance for which all apple growers must feel duly thankful.

BEE COMBS AND FRAMES.

H. Willoughby Lance, Apiculturist.

Next in importance in the production of honey to the stocking of hives with pure bred bees of a good strain, is the provision of good combs and the careful and intelligent arrangement of them in the hive. Very often this is overlooked by beekeepers either owing to lack of knowledge or carelessness.

The invention of the movable frame and wax foundation and the centrifugal extractor during the last century entirely revolutionised beekeeping and enabled beekeepers to regulate the rearing of brood, reduce swarming, and produce larger crops of honey, and the scientist to study with exactitude the economy of the hive. The days are past when at the end of the season the beekeeper, to obtain the crop of honey, had to either destroy the bees or drum them into another skep or box,

cut out the comb, and separate as far as possible the brood comb from the combs of honey, which were crushed and often contained small quantities of eggs, brood, or pollen. The honey was then strained, but all the straining could not rid the honey of the flavour of the brood and pollen.

Present day methods are absolutely hygienic, as anyone can testify who has witnessed the removal of honey from the hives, and its extraction and preparation for the market.

Good combs can be used for many years for brood rearing or the storage of honey. To obtain these a good pattern of Root Hoffman self-spacing frames should be used, and the Victoria pattern with square sides is recommended.

There are four sizes of standard frames at present in use in Australia. These are similar to those generally used in America, where they have several other sizes. The dimensions of our frames, however, are different from those generally used in Britain. All four sizes are of the same length, that is 19 inches long, with projecting tags for suspension in the hive, the only difference being in the depth. The standard size is 9⅛ inches deep, and is generally used by all the large beekeepers for both the brood chamber and the supers or honey chambers. The three-quarter depth or W.S.P. frame, which is 7⅛ inches deep, has only come into use recently and is favoured by some beekeepers as it allows more gradual expansion of the hive for brood rearing or storage purposes.

The Bolton or Ideal frame is 5⅜ inches deep, and was originally introduced for the same purpose as the W.S.P. and for controlling swarming by Bolton's method of reversing the combs. The half depth is 4½ inches deep, and is intended for use as a super for honey storage when the flow is not heavy enough for the full depth frame. The advantage of using this frame for storage as against the Ideal or W.S.P. is that the standard extractor will take two frames in the place of one standard full depth; whereas it will only take one Ideal or W.S.P.

Another important recent use for the half depth or Ideal frame is to place a box of these full of honey on the hive as a food chamber for the winter and spring brood rearing. Colonies with food chambers are ensured against starvation and come out stronger and start brood rearing earlier than those with a scarce supply of honey.

All frames should be strongly wired and fitted with full sheets of foundation. The only exception is where swarms are hived. These may have starters instead of full sheets, as swarms are in a condition for comb building and invariably build worker comb in the first instance, but the practice is questionable even in this instance.

There are several methods of wiring. Three of the most general are illustrated herewith. Fig. 1 with four parallel wires is the simplest, and probably the most general, and is adapted for electrical embedding, whereas the other two have to be embedded with a warm spur wheel. Frames as purchased usually have four small holes drilled in the end bars ready for the wire. Two small tacks should be driven half home, one near the top hole and one near the bottom hole of one end bar at Nos. 1 and 8. Now take the reel of wire, which should not be of smaller gauge than No. 28 B.W.G. Thread the wire through the holes and twist the end round the tack; drive it home; stretch the wire until it twangs like a musical instrument; twist round the other tack and drive home. When fitting the foundation, the frame should be placed upside down and the foundation threaded between the wires, so that the wires are on alternate sides of the foundation, which must now be secured to the top bar. If an electrical embedder is used, contact is made

at each end of the wire for a few seconds until the wire is warm and sinks into the wax. If a spur wheel embedder is used, this is heated in a flame and run along the wire quickly and evenly and presses the wire into the warm wax.

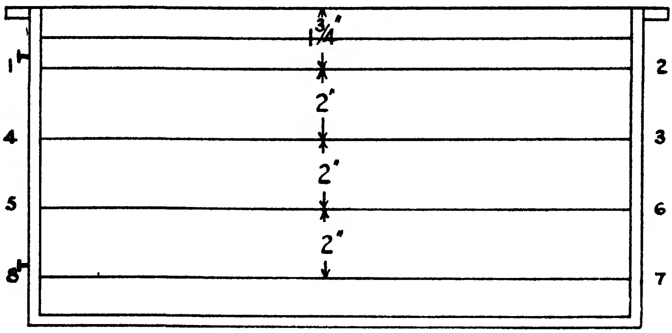


Fig. 1.

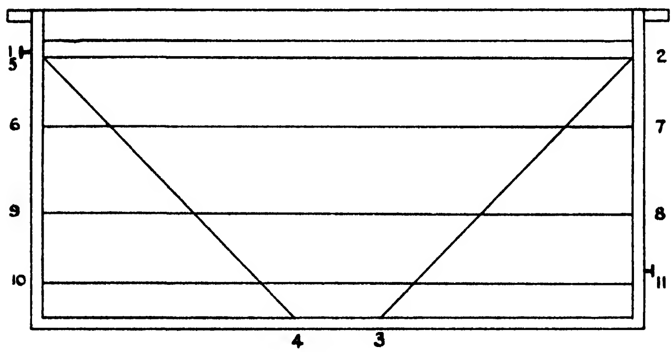


Fig. 2.

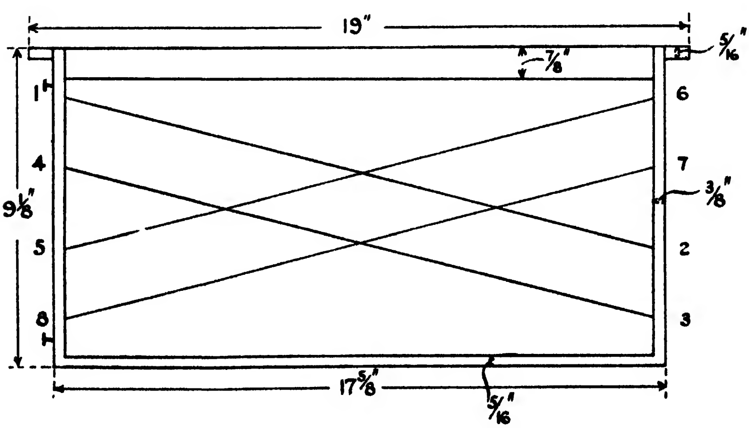


Fig. 3.

The wiring of figures 2 and 3 is similar, but the method of threading varies, as shown by the numbers. Some beekeepers use No. 26 galvanised iron wire for wiring No. 2, which makes a very strong comb not liable to break in the extractor.

The wiring of frames and fitting of foundation is one of the beekeeper's most tedious jobs, and is a comparatively slow process. Much thought and time have been spent by inventors to improve the strength of combs and the saving of time, such as aluminium foundation and other substitutes for wax, but none has been adopted to any extent. Two of the latest are three-ply foundation and wired foundation, both of which are being used to a large extent in America. The three-ply foundation is made of three very thin sheets of wax, the centre one being of vegetable wax for strength and the two outer ones of natural beeswax. This is used and fitted in the same way as ordinary foundation.

The wired foundation was first made by Dadant and Sons, U.S.A., and is now also made in a slightly different pattern by Pender Bros., N.S.W. I have tried the Dadant foundation, which is used in special frames with slotted bottom bars, and find that it does away with the tedious wiring and embedding and saves about 75 per cent. of time. The combs drawn out by the bees are as perfect as one could desire—working cells from top to bottom bar with only an occasional pop hole in the corners.

The Pendar wired foundation is similar, but has straight vertical wires instead of crimped, and the fixing to the bottom bar is slightly different, but the resultant combs should be as good as the Dadant, and I would strongly recommend bee-keepers to give it a trial.

It should be borne in mind that there are four main reasons for preparing the frames as above:—

(1) These combs when completed, will be much stronger than those that the bees would build if left alone.

(2) They will be straight down from the top bar and not liable to be built across the frames.

(3) As all foundation is embossed with the bases of worker cells, the bees will build worker-cells thereon, except in a few cases where they will change to drone cells previous to swarming. If left to themselves, they usually build a large amount of drone cells, and rear an excessive number of drones instead of workers.

(4) Experiments have proved that to make 1 lb. of wax, bees consume from 12 to 16 lbs. of honey; therefore for every 1 lb. of wax foundation supplied, the bees will store an extra 12 to 16 lbs. of honey.

The next job is to get the frames of foundation drawn out into full combs. They may be given to either swarms or to colonies that are rapidly increasing in numbers, or when there is a prospect of a honey flow. If the swarm is small or the bees are only increasing slowly, it is best to give only two or three frames of foundation at a time, because if there is only a little honey coming in, the bees often tear down some of the foundation to use on other frames. Also in cool weather an excessive number of frames of foundation reduces the temperature of the hive.

Now as to the situation of frames in the hive. It must be remembered that the brood nest is usually in the centre and warmest place of the hive, and that the bees cluster thereon to hatch the brood. The outer circle of these centre combs contains pollen and honey, and the combs next to the brood nest also contain pollen and honey, being easily accessible to the young bees that have to feed on them to make the chyle or milk food for the larvae. Next come combs of honey, and lastly, if there is still room, combs in course of construction.

The natural place, therefore, for undrawn foundation is on the outside. However, in warm weather when there is plenty of honey coming in and breeding taking place, single combs may be placed next to the brood nest, as this hastens their drawing out, the bees being anxious to fill them with brood or food. A good time to get the combs drawn out is when the spring is well advanced and the brood chamber full of bees, brood, and honey. It should be the aim of all beekeepers to get two chambers full of brood and honey before trying to secure any surplus honey. To do this, take a body the same size as brood chamber to use as a second storey. Now take two or three frames of brood out of the bottom chamber and place in the centre of the second; close up the remaining brood combs and place frames of foundation on each side between them and the combs of honey, first damaging the cappings of any honey above the brood. The bees will then remove the honey and the queen will deposit eggs therein; otherwise there might be a bar of honey between the two chambers which the queen would not pass. If there is only a little honey in the brood combs placed in the second storey, it would be as well to transfer a comb of honey with them. Now fill up the second chamber with the frames of foundation, and close up. If the season is good, and the queen young and of a good strain, it is surprising how quickly she will fill the two chambers ready for the main honey flow, when a further one or two bodies may be placed on top. No excluder will be needed if the beekeeper manipulates the frames in the two lower chambers correctly, as the queen seldom climbs to the third storey unless overcrowded below.

In the manipulation of hives with old combs, the dark worker combs should always be placed in the centre where the brood nest is, and any drone combs on the outside next to the walls of the hive, as this is the last place the queen will lay in; unless, of course, drones are required for mating purposes, in which case one or two such combs should be placed in the centre. Drone combs may also be placed in the supers for the storage of honey.

Dark worker combs are also useful to place in the second storey next to the brood, or with a swarm that has been hived; one comb of brood and one dark worker comb for the queen to lay in will often prevent the swarm from absconding.

The cells of combs that have been used for the rearing of many generations gradually become smaller, as each chrysalis leaves a thin skin behind it. When these cells are noticeably small, the combs should be replaced, otherwise the young bees will not be able to develop to their natural size.

Badly damaged combs, or those with an excessive amount of drone cells, or those which have sagged and been patched up by the bees, so that there are a number of irregular cells that cannot be used for brood rearing, should never be placed in the brood nest, but should be taken away and melted down; otherwise there will be so much waste space where every inch is valuable, brood rearing of the workers will be restricted, and the tendency to swarm will be increased.

Stretched cells on the upper portion of the combs in the lower brood chamber have a tendency to act as a bar to the queen in passing from one chamber to the other, Should there be any of these, they should be placed in the second chamber. Careful sorting and arrangement of all combs is a great assistance to the beekeeper in the prevention of swarming and the storage of surplus honey.

A CONVENIENT METHOD OF TOP-WORKING CITRUS TREES.

RAY C. OWEN, Dip. Agric.,
Orchard Supervisor.

In these days of reduced returns for primary products it behoves every orchardist to keep the cost of production at a minimum. This cannot be done unless the orchard is 100 per cent. efficient, that is unless every tree is producing regular crops of good quality fruit. All unhealthy trees should be given proper treatment, or if they are at a stage where it would not pay to treat them, they

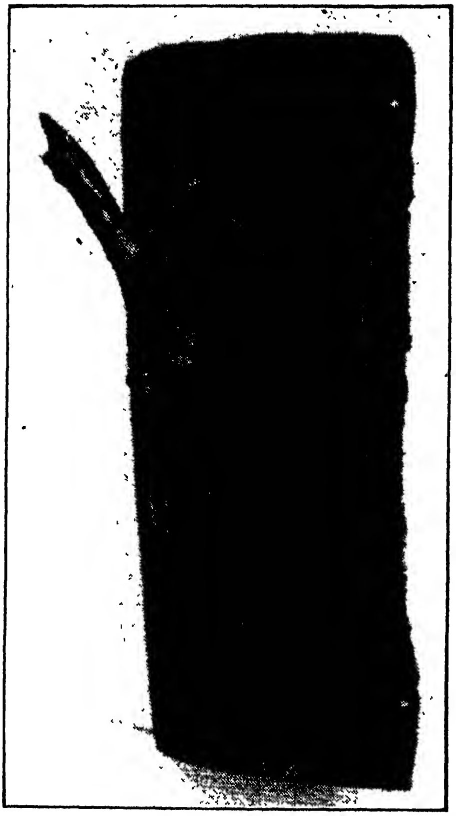


Fig. 1.—The side bark graft after the binding has been removed, showing how the scion has healed in.

should be grubbed out. Any healthy trees that are producing inferior quality fruit, or fruit for which there is no market, should be worked over to varieties which are profitable and suitable to the particular district.

In the issue of the *Journal* for June, 1932, several methods of top-working were described, and any orchardist who is handy with tools will find the work very interesting and quite easily performed. A convenient method of top-working citrus

is by using the side bark graft. This may be used alone, or in conjunction with the cleft graft. The chief advantage of the side graft is that the tree is not cut back until after the scions have healed in. Thus, if the grafts happen to fail the tree is in no way disturbed. The grafting is best done in the spring-time—September and October—but fair results may be obtained at any time while the sap is flowing provided that the weather is reasonably cool. The operation is very simple, and is

Fig. 2.—The side graft nine weeks after cutting back, showing vigorous growth of the scion.

performed by first making a "T" incision in the bark of the selected limb, slightly raising the edges of the bark, and then inserting the scion (2-3 buds) which has been prepared by making a long diagonal cut to form a chisel point. A piece of bark immediately above the "T" may be removed so that the scion will fit snugly in position. The graft is then tightly bound in position and waxed over.

When the scion has healed in it usually remains dormant until it is convenient to cut the tree back. The graft then starts into vigorous growth and soon forms a new tree of the desired variety.

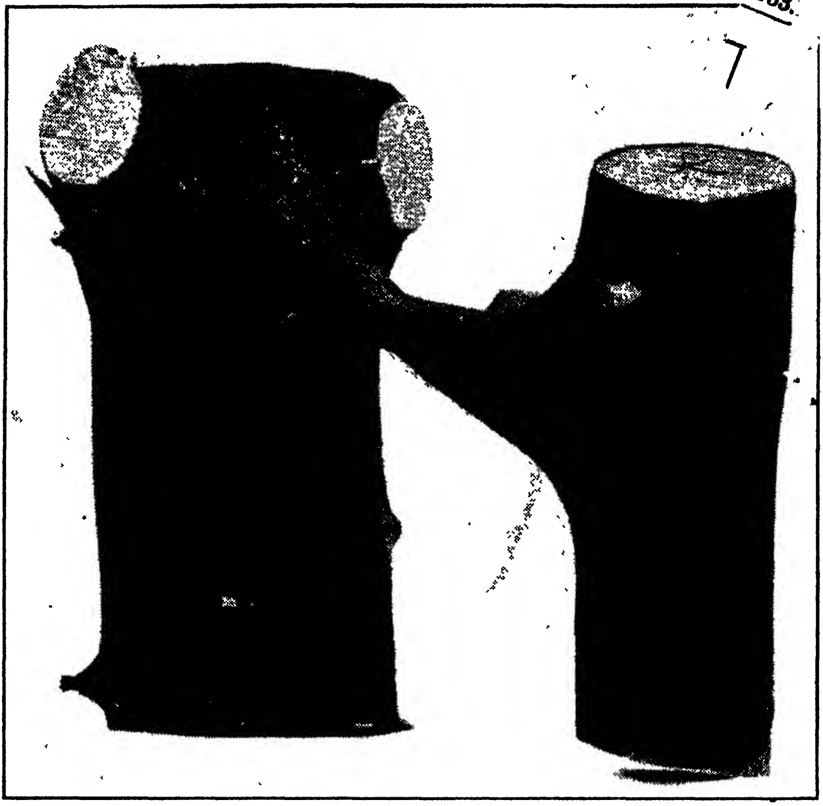


Fig. 3.—A natural graft or inlay. This occurred in Mr. Brown's orchard at Armadale, and was caused by a branch of one limb contacting in the fork of another limb and eventually becoming united.

BARLEY GROWING.

Review by R. P. Roberts, Agricultural Adviser, of a Barley Survey by Henry Clark Grant (His Majesty's Stationery Office), 2s.

No 62 of the Empire Marketing Board's publications is a comprehensive study of barley production, exports, imports, marketing, markets and prices in the principal exporting and importing countries of the world, made by Professor H. C. Grant, of the Department of Agricultural Economics in the University of Manitoba.

The volume of international trade in barley has shown a decrease from 5 million tons in 1909-13 to about 3¾ million tons in 1926-30. This decrease is not due to an expansion in production in the chief importing countries, but to a definite decline in consumption.

The United Kingdom and Germany absorb two-thirds of the world's surplus, and Belgium, the Netherlands and Denmark a further 20 per cent. The main exporting countries are Canada, the United States, Roumania and Russia.

The study gives consideration to the characteristics and uses of barley, world production, and trade and prices. It deals in some detail with the chief importing and exporting countries, but particularly with the United Kingdom as an importer and Canada as an exporter. The problem of finding markets for the increasing surpluses of the chief producing areas is a pressing one. In England, for example, the supply of high-grade malting barley—two-row barleys—is normally in excess of demand.

Dealing with Australia's position as an exporter, the author remarks:—"Eighty-six per cent. of the total barley acreage in Australia is sown to malting barley, and their exports are practically all of this class. No doubt more barley could be produced and the quality of export shipments of malting barley be improved by better seed and better harvesting methods. It is doubtful, however, if the existing demand for malting barley of this kind in the United Kingdom would remunerate the Australian producer for the extra cost and effort involved in attempting to gain a greater share in a market already over-supplied." And again "......any attempt to encourage the production of malting barley in Canada, Australia or California, with the hope of selling more malting barley or malt to the United Kingdom, is hardly worth the effort."

From the Western Australian standpoint there is an item of particular interest. For the manufacture in England of light, sparkling, filtered bottle beers it is essential that 25 per cent. to 40 per cent. of high-quality, sun-ripened, six-rowed barley must be used in the composition of the grist. This has not yet been produced within the Empire. Supplies are drawn almost solely from California from a region of light but fertile soil, heavy rains during the early growing season and virtually no rain nor cloudy weather during ripening and harvest. The most ideal conditions for quality production are reached in the Sacramento Valley, where the temperature may reach 100deg. at harvest and the crop receives less than 10in. of rain in the growing period.

This barley is held in high repute by English maltsters and has consistently provided appreciable quantities of the imports into the United Kingdom. It is known as Californian Bay Brewing Barley.

As Western Australia possesses a climate very similar to that of California, as there is now a 10 per cent. Empire preference on imported barley, and as the manufacture of beer is now permitted in the United States, and will probably absorb a certain percentage of the Californian crop, it would appear that further investigations might be made with profit as to the possibilities of growing the Californian type of malting barley in this State. Any export, of course, would have to be made in face of the strong Californian competition.

Professor Grant has included numerous tables, graphs, and diagrams to supplement his conclusions. There is also a comprehensive appendix dealing with production, acreages, exports, imports, etc., in the various countries of the world. The book is invaluable to anyone who wishes to obtain a correct picture of the present day position of the world trade in malting barley.

ARTIFICIAL MANURE SUBSIDY.

1. The Commonwealth Relief Act of 1932 provides for the payment *to primary producers* throughout Australia of a subsidy of 15s. per complete ton of artificial manure used by such primary producers in the production of primary produce other than wheat during the year ending 30th November, 1933.

2. This means that, providing a primary producer has applied to the soil during the period 1st December, 1932, to 30th November, 1933, one ton of artificial manure in connection with the production of any primary product, *except wheat,* he will be eligible to claim 15s. subsidy. If he has used two tons during that period he will be eligible to receive 30s., and so on; but if he has used less than one ton no subsidy is payable, as the Act prescribes that, in calculating amounts of subsidy, fractions of a ton shall be excluded.

3. The financial assistance in regard to the use of artificial manure applies to primary producers in respect of every product except wheat. Special provision has, of course, been made for wheatgrowers under Commonwealth grants distributed by the States. Producers of oats, hay, barley, hops, beans, apples, pears, citrus fruits, tobacco, etc., will therefore be eligible to claim the subsidy, which will also apply to artificial manure used in top-dressing of pastures.

4. Artificial manure for purposes of the Act is any substance which contains nitrogen, phosphoric acid or potash, and hich has been manufactured, produced, or prepared in any manner for the purpose of fertilising the soil or supplying nutriment to plants, but does not include any animal or vegetable matter which has not been subjected to process of manufacture.

Lime does not come within the meaning of artificial manure for the purposes of the Act.

5. Applications for subsidy must be made in ink on a special form, which form also contains a declaration to be completed by the primary producer in the presence of either a Commissioner for Declarations, a J.P., Bank Manager, Postmaster, Station-master, or Constable or Officer of Police. No other official is authorised to take this declaration.

6. Upon completion of the claim and supporting declaration the producer is required to forward same to the Head Office of the firm from which his supplies of artificial manures were obtained. The supplying firm will then certify as to the quantity or quantities of manures actually supplied to the claimant, and will forward the form direct to the Fertiliser Subsidy Section. Certificates from local agents of the manufacturing or supplying firms will not be accepted.

7. It will be noted that primary producers are not eligible to submit applications for the subsidy until they have actually used the artificial manure in regard to which they desire to claim financial assistance. They should use the full quantity of artificial manure which they intend to apply in regard to any particular product before submitting an application. A claim should not be submitted in regard to a portion of the quantity used and then submit one or more claims for the remainder. The Department of Commerce hopes that in most cases it will be necessary for only one claim to be made by primary producers, but it is recognised that in special circumstances two claims may be necessary.

8. Producers are requested to exercise every care in completing their claims so as to ensure that they claim the subsidy only in respect of artificial manure *used* during the period 1st December, 1932, to 30th November, 1933. If the artificial manure was applied to the soil prior to 1st December, 1932, no subsidy is payable. It must also be used prior to 30th November, 1933, to be eligible for the subsidy.

All particulars asked for on the form of application must be filled in by the applicant, the area planted and quantity of manure used for each different class of produce being separately shown. Unless claims are properly signed and completed delay in payment of the subsidy will be occasioned as a result of the necessity for their return to producers for completion or correction.

9. Forms of application are now obtainable at all country post-offices throughout the State or direct from the Fertiliser Subsidy Section, G.P.O. Building, Perth.

ROYAL AGRICULTURAL SOCIETY.

SUMMER FODDER CROP COMPETITION.

(G. K. Baron-Hay, Superintendent of Dairying.)

The following results of the Summer Fodder Crop Competition conducted by the Royal Agricultural Society for the Season 1933 are now available.

Judging was carried out by Messrs. M. Cullity, H. G. Elliott, Agricultural Advisers, and C. Giles, Dairying Instructor, attached to the Department of Agriculture.

The season generally, owing to the dryness of the summer, resulted in poor growths of summer fodder crops, but the results from farms in the Competition show what can be obtained where careful attention is paid to cultivation of the soil.

Particulars of the points gained and the methods of cultivation adopted by the competitors are shown in the following tables:—

Competitor.	Yield. 50	Evenness of Growth. 10	Freedom from Weeds. 15	Cultivation. 15	Freedom from Disease. 10	Total Points. 100
A. Rodway, Harvey ...	49	8	15	14	7	93
L. Pearson, Benger ...	36	8	14	14	10	82
H. Brown, Manjimup ...	34	9	13	15	10	81
H. F. Jay, Yanmah ...	30	4	12	13	9	68
M. Wells, Busselton ...	21	5	15	15	10	66

The following are the particulars regarding the methods of cultivation, fertiliser, etc.:—

——	A. Rodway.	L. Pearson.	H. Brown.	H. F. Jay.	M. Wells.
Date weight taken ...	7-3-33	24-1-33	10-5-33	25-3-33	17-2-33
Drills apart	33 inches	32 inches	36 inches	24 inches	24 inches
Average height	5-7ft.	6-10ft.	8-9ft.	0-14ft.	6½ft.
Fertiliser—Rate per acre ...	3 : 1 super and ammonia plus Potash 8 cwt. per acre	Bone, super and potash 3 cwts per acre.	5 : 1 super and ammonia 300 lb. per acre	5 : 1 : 1 super, ammonia, and potash 650 lb. per acre	Super, sulph. ammonia and No. 2 potato manure
Soil	Yellow - red clay loam	Yellow - red clay loam	Brown sandy loam	Sandy	Grey clay loam
Rate of Seeding	...	30lb. per acre	25lb. per acre	20lb. per acre	17lb. per acre
Date of Seeding	1st Nov.	At intervals	15th Jan.	At intervals	At intervals
Estimated weight per acre. Tons.	24·5	17·7	16·9	15·0	10·5

*THE MILKING COW AND HER PASTURE.

GEO. L. SUTTON, Director of Agriculture.

Probably never before in the history of Western Australia and certainly not since the beginning of the present century, has it been so necessary as it is at present for dairymen to produce cheap cream. The world over, good pasture is recognised as the foundation of cheap milk and cream. Because of this, it is appropriate to consider the characteristics of our clover belt pastures to ascertain their possibilities and to determine how they can be utilized to meet the needs of the milking cow for the economic production of cream.

Comparisons between different pastures and foods are usually based upon a study of their composition as disclosed by a chemical analysis. Typical analyses are shown in Table 1. From an examination of the result of such analyses, it will be seen that the constituents can be divided into two main divisions, viz.:—

1. Water, and
2. Dry matter, *i.e.,* matter containing no water and including the ash.

Dry matter contains all the nutrients, *i.e.,* the materials from which the energy is developed, wear and tear made good, and new tissues built up. The dry matter also supplies such bulkiness as is required to meet the capacity of the animal. The capacity of a dairy cow or the amount she is able to consume is from 20 to 30 lbs. of dry matter.

TABLE I.

TYPICAL STOCK FOODS.

Stock Food.	Total in 100lbs. of Food.					
	Water.	Dry Matter.				
		Crude Protein.	Fat.	Nitrogen Free Extract.	Crude Fibre.	Ash.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Subterranean Clover (Hay Stage)	75	4·5	0·75	12·5	5·0	2·25
Fodder Maize	78	1·9	0·6	13·0	5·3	1·2
Lucerne	75	4·75	1·0	11·25	5·0	3·0
Bran	12	16·0	2·0	58·0	8·0	4·0
Oats	12	9·0	5·0	58·5	11·5	4·0

Though water contains no nutrients, it is nevertheless very important, since it is the medium by which the nutrients are able to function. It is also an important constituent of the blood and of every tissue, especially of the muscles and vital organs. It constitutes quite one half of the weight of the body. It serves to carry away most of the waste products that arise from the activities of the body, particularly those secreted through the kidneys and retention of which in the body would rapidly constitute a serious menace to the health of the animal.

In consequence, neglect to provide the animal with adequate water supplies for its needs will restrict the production of that animal, just as quickly as the neglect to supply any other food ingredient. It is therefore obvious that the pas-

* Prepared by courtesy of the Australian Broadcasting Commission from notes of an address broadcasted from 6WF on 8th May, 1933.

ture for the dairy cow should be succulent and any shortage of moisture in the pasture must be supplied from other sources.

Few dairymen realise the quantity of water which is essential to meet the requirements of high producing cows. A milch cow requires about 4 lbs. of water for every pound of *dry* matter consumed and at least 2 lbs. for each pound of milk produced. Thus a three-gallon cow will require 70 to 80 lbs. of water for general purposes, and about 60 to 70 lbs. for milk production, or a total of 130 to 150 lbs. = 13 to 15 gallons daily.

As will be seen from the comparison of some well-known stock foods as shown in Table 1, the nutrients in the dry matter are divided into five groups, viz.:—

1. The ash or mineral matter.
2. Crude proteins.
3. Fats, oils, etc.
4. Carbohydrates.
5. Fibre or cellulose.

Until comparatively recently it was considered that the mineral content of a pasture or fodder was of such minor importance that it could be neglected provided the animal was furnished with sufficient nutrients from the other groups to meet its requirements.

Investigations have shown clearly that mineral deficiencies are far more commonly responsible for unsatisfactory results with stock than was previously suspected.

Only extremely minute amounts of most minerals are required and will be adequately supplied in the food. The most common mineral elements found in foods are:—Lime, phosphate, and the two constituents of common salt, viz., soda and chlorine. The two most likely to be deficient in Western Australia are phosphate and lime, but cows receiving reasonable supplies of leguminous fodder, as would be the case in the clover belt, are not likely to suffer from a deficiency of lime. Our pastures as they become mature do become deficient in phosphates and need supplementing in this respect. Suitable supplements are:—Dicalcic phosphate containing 37 per cent. of phosphoric acid sterilized bonemeal containing 22 per cent. phosphoric acid, and proprietary licks having either or both of these materials as their base. The minerals sodium and chlorine can be supplied by feeding common salt and, in consequence, it is quite a common practice to mix Dicalcic phosphate and bonemeal with stock salt to form a lick.

Incidentally it may be stated that a deficiency of phosphate in the pasture is one of the causes of sterility in dairy cows, and is believed to be the principal cause of botulism or "toxic paralysis" which has caused such enormous stock losses during the present autumn.

The feeding value of the other four groups of nutrients (crude protein, fats, carbohydrates, and fibre) cannot be reliably measured by an examination of the composition of the food as disclosed by an analysis. It is equally important to take into account the digestibility of the different constituents, for it will be readily realised that the quantity digested is of more importance than the amount eaten. Further, the digestion of food and other work performed by the internal organs of the body involves the expenditure of energy, the cost of which is borne by the food.

The value of a fodder depends, therefore, upon three factors:—

1. Its composition,
2. Its digestibility, and
3. The cost of digesting it.

The nutrients, crude protein, fats, carbohydrates, and fibre have one feature in common, viz., each is capable of producing in the animal's body compounds—like fats and sugars—which the animal can later transform into energy. Hence the respective capacities of each of these nutrient groups for this purpose is known as its "energy value," the sum of all being the energy value of the food.

Just as a merchant finds it necessary to convert different national currencies to a common denomination—a British merchant to pounds sterling—an American merchant to dollars—so it has been found convenient to express the energy value of foods as one denomination. The denomination chosen has been that of starch, which is a rich and easily digested carbohydrate. The energy value of a food is therefore commonly expressed in terms of its *starch equivalent*.

The constituents of the protein group are the only ones which contain nitrogen, and as this element is a constituent of muscle and certain other animal products, it follows that the proteins are essential for the building of these new products and to repair the wear and tear of the animal body. In consequence, when considering the value of a food, it is necessary to take into account the proportion of protein in the food as well as the total nutritive value of it, and, as previously pointed out, also its mineral content.

Having realised that the value of a pasture or fodder depends upon—

1. The protein content;
2. The *starch equivalent* or energy value of its nutrients including that of the protein; and
3. Its mineral content;

it is now opportune to discuss the relative value of our clover belt pastures, using the best available details relating to subterranean clover as being typical of them.

It will be convenient to give consideration at first to the energy value and to deal with the phosphatic aspect as representing the deficient mineral content separately and later.

With extreme differences at the beginning and end of the season, it is obvious that there is a considerable variation in the quality of the pasture throughout its length. For the purposes of comparison, pastures of three definite types are taken. These are—

1. Young pasture 3in. to 5in. high;
2. Hay stage pasture, *i.e.*, when the seed is forming, but not maturing;
3. Mature pasture when matured and dry in the field.

The available figures show the composition of Subterranean pasture to be as follows:—

SUBTERRANEAN CLOVER.

—	100 lbs. contain.		
	Water.	Digestible Crude Protein.	Production Starch Equivalent.
	%	%	%
Young Pasture	82	3·4	12
Hay stage pasture	75	2·7	11
Mature pasture	10	4·0	27

These figures show that the mature pasture contains slightly more protein and twice as much starch equivalent as the young pasture, thus indicating that it is that much more valuable as a fodder, and so it is *pound* for *pound*. This, however, does not present a correct picture of the relative values, for, as has been pointed out, it is the nutritive value of the *dry matter* that has to be considered. When this is done, we find 100 lbs. dry matter contains—

—	Digestible Crude Protein.	Production Starch Equivalent.	Phosphoric Acid.
	%	%	oz.
Young pasture	19	68	22·4
Hay stage pasture	10·8	44	9·6
Mature stage pasture	4·5	30	6·4

Now what a change in values! The young clover stands out tremendously in the forefront. It contains nearly twice as much dry digestible protein as at the hay stage, whilst its starch equivalent is over 1½ times greater. Its advantage over the matured clover is even greater. It contains over four times as much protein and its starch equivalent is over twice as great. Astonishing as it may seem to some, the young clover pasture with its starch equivalent of 68 and protein content of 19 is a richer food than bran with a starch equivalent of 54 and protein content of 15.

Now let us see how the various types of clover meet the requirements of the milking cow. To do this it will be necessary to use what are known as feeding standards for milking cows, and for this purpose it is proposed to use those based upon the classical work of the German investigator Kellner. These are given in Table II.

TABLE II.

STANDARD REQUIREMENTS.

MILCH COW—750lbs. WEIGHT.

Dry matter—20–30lbs.

For.	Standard Requirements.		
	Digestible Crude Protein.	Productive Starch Equivalent.	Phosphoric Acid.
	lbs.	lbs.	ozs.
Maintenance	0·5	4·5	0·8
One Gallon Milk	0·6	2·5	0·3
Total 1 Gallon Milk	1·1	7·0	1·1
" 2 " "	1·7	9·5	1·5
" 3 " "	2·3	12·0	1·8
" 4 " "	2·9	14·5	2·1
" 5 " "	3·5	17·0	2·4
" 6 " "	4·1	19·5	2·8
" 7 " "	4·7	22·0	3·1

From the above table it will be seen that a cow weighing, say, 750 lbs., requires:

——	Digestible Crude Protein.	Production Starch Equivalent.
	lbs.	lbs.
For maintenance	·5	4·5
For each gallon, of 4 per cent. milk	·6	2·5

and so on with proportional additions for each gallon of milk produced.

It is important to emphasise that the maintenance is the same whether the cow is producing 1 gallon or 5. These feeding standards are intended as a guide to supplement the experience of the feeder and not take its place and in this connection they serve an excellent purpose.

Assuming an abundance of young pasture available, a cow eating 140lbs., supplying 25 lbs. of dry matter, would obtain 4.7 lbs. protein and 17.0 starch equivalent, or sufficient starch equivalent and more protein than is necessary for a cow producing 5 gallons of milk.

In view of the excess of protein it is pertinent to consider whether the addition of some supplement to the pasture would not provide a more balanced ration. In Table III. the digestible nutrients of the best known supplements will be found.

TABLE III.

PASTURE SUPPLEMENTS.

Stock Food.	Total in 100lbs., Dry Matter.		
	Digestible Crude Protein.	Productive Starch Equivalent.	Phosphoric Acid.
	lbs.	lbs.	lbs.
Bran (wheaten)	14·6	54	2·12
Wheat	10·2	83	0·79
Barley	9·3	85	0·93
Oats	8·0	71	1·05
Linseed Meal	29·0	80	1·90
Clover Hay	10·8	44	0·6
Oaten Hay	4·8	41	0·2
Poor meadow Hay	...	12	...
Lucerne—in flower	14·0	42	0·76
Fodder Maize	5·0	57	0·50
Silage—mixed pasture	8·4	40	0·56

In this connection it should be pointed out that the composition of a stock food is not constant, but varies as the result of many factors, and the figures given in that table have been selected from those available as being representative of the

food to which they refer. With this information available it has been possible to draw up a number of rations with young subterranean clover as a base and compare them with a ration of pasture only. These rations will be found in Table IV.

TABLE IV.

SUBTERRANEAN CLOVER—YOUNG STAGE.

Ration.	Weight.	Composition.			
		Dry Matter.	Digestible Crude Protein.	Productive Starch Equivalent.	Phosphoric Acid.
	lbs.	lbs.	lbs.	lbs.	ozs.
1. Pasture	140	25	4·8	17	5·6
2. Pasture	110	20	3·8	13·6	4·5
Wheat or Barley ...	6	5	0·5	4·2	0·6
		25	4·3	17·8	5·1
3. Pasture	110	20	3·8	13·6	4·5
Oats	6	5	0·4	3·6	0·8
		25	4·2	17·2	5·3
4. Pasture	83	15	2·9	10·2	3·4
Clover Hay ...	11	10	1·1	4·4	1·0
		25	4·0	14·6	4·4
5. Pasture	110	20	3·8	13·6	4·5
Bran	6	5	0·7	2·7	1·7
		25	4·5	16·3	6·2
6. Pasture	83	15	2·9	10·2	3·4
Oaten Hay ...	11	10	0·5	4·1	0·3
		25	3·4	14·3	3·7
		Phosphatic	Lick needed.		
7. Pasture	83	15	2·9	10·2	3·4
Poor Meadow Hay ...	11	10	...	1·2	...
		25 Phosphatic	2·9 Lick needed.	11·4	3·4

From this table it will be seen that it is not possible to balance the excess of protein with the supplements available, but that wheat, barley or oats could be used to supplement a scarcity of pasture without reducing the productivity of suitable cows. For lower producing cows oaten and clover hay are useful supplements, with even poor meadow hay for low producers or cows advanced in lactation period. Here it may be stated that young pasture will enable the most to be made of the inferior hay, but of course such fodder cannot be used profitably with high producing animals.

So many farmers are accustomed to regard bran as highly as to consider that it must be an improvement in any ration. This, however, is not so, and evidence in this connection is furnished by a comparison of ration 5, with pasture only, and

rations 2 and 3. A comparison of these latter two shows that, with young pasture, bran is inferior to wheat, barley and oats.

Neither is bran indispensable, as many dairymen think. Admittedly it is a very valuable and convenient fodder for dairy cows, but, like other fodders, it is valuable because it supplies energy-producing material. Sometimes the nutrients supplied by bran can be supplied more cheaply by other foods. This is illustrated in Table V. in which 200 lbs. of a mixture of linseed and meal replaces 300 lbs. of bran. This mixture supplied the same amount of protein and almost the same production starch equivalent as the bran, and, in 1931, effected a saving of nearly £2 per ton of bran, though at the present quotations the advantage is slightly in favour of the bran.

TABLE V.

SUBSTITUTE FOR BRAN.

Fodder.	Weight.	Composition.		Cost.	
		Protein.	Productive Starch Equivalent.	1931.	1933.
	lbs.	lbs.	lbs.	s. d.	s. d.
Bran	330	35·0	148·5	28 1	18 6
Oats	100	8·0	59·5	8 6	5 0
Linseed Cake	100	27·8	74·5	13 6	14 6
Mixture	200	35·8	134·0	22 0	19 6
Loss or saving on 330lbs. Bran				+ 6 1	— 1 0
Loss or saving on 1 ton Bran				+ 36 10	— 6 0

+ equals Saving, — equals Loss.

With pasture at the hay stage, a cow consuming 30 lbs. of dry matter contained in 120 lbs. of pasture would obtain 3.2 lbs. digestible crude protein and 13.2 lbs. starch equivalent. This is sufficient starch equivalent for a 3-gallon cow with an excess of protein. It would be difficult to increase production on this pasture without the addition of a purchased concentrate like wheat, barley, or oats, or a mixture of one of these with linseed meal. The most suitable home grown supplement for this purpose would be green lucerne, but even this would not make a very material difference as its starch equivalent is only 45 compared with that of 40 for the pasture. Bran would be slightly better, as it has a starch equivalent of about 54. A mixture of linseed meal and ground wheat would be much better, and with such a mixture supplying one-third of the dry matter, the nutrients supplied would be sufficient to increase the production from 3 to between 4 and 5 gallons. But with butter fat ranging around 10d. per lb., it is very doubtful whether any purchased concentrate could be used with profit. Such a condition emphasises the need for the dairy farmer in Western Australia to regard himself as the producer of pastures and fodder crops for which his milking cows are the market.

The rations compounded with hay stage pasture and the supplements referred to will be found in Table VI.

TABLE VI.

SUBTERRANEAN CLOVER.

HAY STAGE.

Ration.	Weight.	Composition.			
		Dry Matter.	Digestible Crude Protein.	Productive Starch Equivalent.	Phosphoric Acid.
	lbs.	lbs.	lbs.	lbs.	ozs.
1. Pasture	120	30	3·2	13·2	2·9
		Phosphatic	Lick needed.		
2. Pasture	100	25	2·7	11·0	2·4
Wheat or Barley ...	6	5	0·5	4·2	0·6
		30	3·2	15·2	3·0
		Phosphatic	Lick needed.		
3. Pasture	100	25	2·7	11·0	2·4
Oats	6	5	0·4	3·6	0·8
		30	3·1	14·6	3·2
		Phosphatic	Lick needed		
4. Pasture	80	20	2·2	8·8	1·9
Linseed Meal ...	6	5	1·5	4·0	1·5
Wheat or Barley ...	6	5	·5	4·2	·6
		30	4·2	17·0	4·0
5. Pasture	80	20	2·2	8·8	1·9
Lucerne	40	10	1·4	4·2	1·2
		30	3·6	13·0	3·1
		Phosphatic	Lick needed		
6. Pasture	100	25	2·7	11·0	2·4
Bran	6	5	·7	2·7	1·7
		30	3·4	13·7	4·1

And now consideration of the dry mature pasture. 33 lbs. of this will supply 30lbs. of dry matter from which the cow could obtain 1.35lbs. digestible protein and starch equivalent 9.0lbs., about sufficient for a cow producing 1½ gallons. Even for moderate producers, some home grown supplement, as a mixture of lucerne and fodder maize, is definitely indicated.

By dividing the dry matter requirements about equally amongst the three fodders, pasture, lucerne, and green maize, the production of suitable cows can be raised to the three-gallon class. Supplementary mixtures of clover and oaten hay, though not as good, will so improve the quantity of nutriments supplied as to

render a production of two gallons probable. Possible rations with mature pasture and supplements will be found in Table VII.

TABLE VII.

SUBTERRANEAN CLOVER.

MATURE STAGE.

Ration.	Weight.	Composition. Dry Matter.	Digestible Crude Protein.	Productive Starch Equivalent.	Phosphoric Acid.
	lbs.	lbs.	lbs.	lbs.	ozs.
1. Pasture	33	30	1·4	9·0	1·9
		Phosphatic	Lick needed	badly.	
2. Pasture	11	10	0·5	3·0	0·6
Lucerne	40	10	1·4	4·2	1·2
Fodder Maize ...	45	10	0·5	5·7	0·8
		30	2·4	12·9	2·6
		Phosphatic	Lick needed	badly.	
3. Pasture	22	20	1·0	6·0	1·2
Clover Hay ...	11	10	1·1	4·4	1·0
		30	2·1	10·4	2·2
		Phosphatic	Lick needed	badly.	
4. Pasture	22	20	1·0	6·0	1·2
Oaten Hay ...	11	10	0·5	4·1	0·3
		30	1·5	10·1	1·5
		Phosphatic	Lick needed	badly.	
5. Pasture	28	25	1·1	7·5	1·6
Bran	6	5	0·7	2·7	1·7
		30	1·8	10·2	3·3
6. Pasture	11	10	0·5	3·0	0·6
Linseed Meal ...	12	10	3·0	8·0	3·0
Wheat or Barley ...	12	10	1·0	8·4	1·2
		30	4·5	19·4	4·8
		Phosphatic	Lick needed.		

The relative natural productivity of the three types of pasture would appear to be:—

Young	5 gallons
Hay	3 gallons
Mature	1½ gallons

And now, how do these types of pasture supply the necessary phosphate?

The young pasture is richest in this respect, containing 3½ times as much as the mature pasture and 2 1/3rd times as much as pasture in the hay stage.

A daily ration of young pasture providing 25 lbs. of dry matter will contain over 5ozs. phosphoric acid. It is estimated that one-half to one-third of the phos-

phoric acid in this pasture would be assimilated; assuming the larger proportion to be available, there would be sufficient to meet the requirements of a 5-gallon cow and for which the other nutriments are also available.

Thirty pounds of dry matter in the pasture at the hay stage contains nearly 3ozs. of phosphoric acid. Assuming that one-half of this is available, then the pasture would supply only sufficient phosphoric acid to meet the requirements of a two-gallon cow. As this pasture is capable of supplying the other nutrients required by three-gallon cows, the need for a phosphatic lick is apparent.

At the mature stage, 30 lbs. of dry matter will supply barely 2ozs. of phosphoric acid. With an assimilation at the rate of the previous estimation, this is only sufficient for a one-gallon cow. For higher producers a phosphatic lick is definitely and badly needed.

It will thus be seen that, except when in very young pasture, milking cows should be supplied with a phosphatic lick, and also even when on young pasture, if for any reason they have not been adequately supplied with a phosphatic supplement during the preceding summer.

Between each of the pasture stages referred to, there is a gradual transition from one stage to the other, and, as has been shown, a gradual lowering of the nutritive value. Similarly from the third stage of mature pasture there is a further and gradual decline in food value until the zero stage is reached. Even on the best regulated non-irrigated dairy farms, it may be impossible to prevent the zero pasture stage being reached, particularly after a dry summer and when the autumn rains are belated. When the dairy farmer trusts solely to the pasture for the support of his stock, the results are disastrous and cause untold suffering to the animals, some of which, because of their better constitutions, may survive by existing upon the gradual decomposition of their tissues. The modern dairyman will take steps to prevent this by the conservation of hay and silage and the growth of such summer fodder crops as are possible.

Suggested rations for the period when no pasture is available are given in Table VIII.

TABLE VIII.

NO PASTURE AVAILABLE.

Ration.	Weight.	Composition.			
		Dry Matter.	Digestible Crude Protein.	Productive Starch Equivalent.	Phosphoric Acid.
	lbs.	lbs.	lbs.	lbs.	ozs.
1. Silage	40	10	0·84	4·0	0·9
Clover Hay ...	12	10	1·10	4·4	1·0
Oaten Hay ...	11½	10	0·48	4·1	0·32
		30	2·42 (3)	12·5 (3)	2·22
		Phosphatic	Lick needed.		
2. Lucerne	40	10	1·4	4·2	1·22
Clover Hay ...	12	10	1·1	4·4	1·00
Green Maize ...	50	10	0·5	5·4	0·80
		30	3·0 (4)	14·0 (4)	3·02
		Phosphatic	Lick needed.		

Finally, the outstanding lessons of our clover pasture, as I read them, are:—

1. Young pasture is so suitable for high production that the management should provide for the maximum number of newly-calved cows to come into profit when it is possible to make the greatest use of it.

2. The young pasture stage should be extended as long as is possible by grazing management, so as to keep it short and to delay its maturity.

3. The carrying capacity of the farm should be governed by the quantity of young pasture available rather than by the greater quantity of lower quality hay stage pasture. Such a policy would provide a surplus of hay stage pasture which could be conserved as silage and hay to supplement mature and zero pastures.

4. Additional supplements should be provided as far as facilities permit by growing winter hay crops and summer fodder crops like lucerne, fodder maize, Sudan grass, etc.

FROST INJURY OF WHEAT.

H. A. PITTMAN, B.Sc.Agr., Plant Pathologist.

Very many specimens of wheat plants seriously injured by frost, not only on the heads but also on the stems and leaves, have been received for diagnosis by the Plant Pathology Branch of the Department of Agriculture during recent years, and particularly since 1930 onwards.

Symptoms of Wheat Plants injured by Frost.

As very few of the farmers who have submitted wheat plants affected by frost seem to have had any definite idea of the real cause of the trouble, a description of symptoms which may be brought about by frost may prove of interest.

Frost can affect wheat plants in many different ways as described below:—

(a) *Head Injuries.*

Sometimes all that happens is that the male and female portions of a flower (botanically known as the *stamens* and the *pistil* respectively) are killed by the extreme cold, so that the necessary act of fertilisation which results in seed formation cannot take place. This means that one, several, or all, of the spikelets of the head remain partially or wholly free from grain although they may otherwise develop quite normally. In such a case the crop may appear, on casual observation, to be quite normal until close to harvest time, when it will be found that there is not nearly as much grain present as one had imagined from the general appearance of the crop, many apparently healthy heads being more or less empty.

When the frost is more severe, the wheat head may be considerably malformed. This malformation manifests itself in very marked "shrivelling" or dwarfing and wrinkling of all of the spikelets, or as "shrivelling" of some spikelets only at the top, middle or base of the wheat head. The spikelets immediately adjoining the injured ones in these last three cases may be quite normal in all external respects, sometimes bearing normal grain, and with the change from "shrivelled" to healthy spikelets coming with surprising suddenness. (See Fig. 1.)

Sometimes the heads are completely bleached and empty without the spikelets having the "shrivelled" appearance.

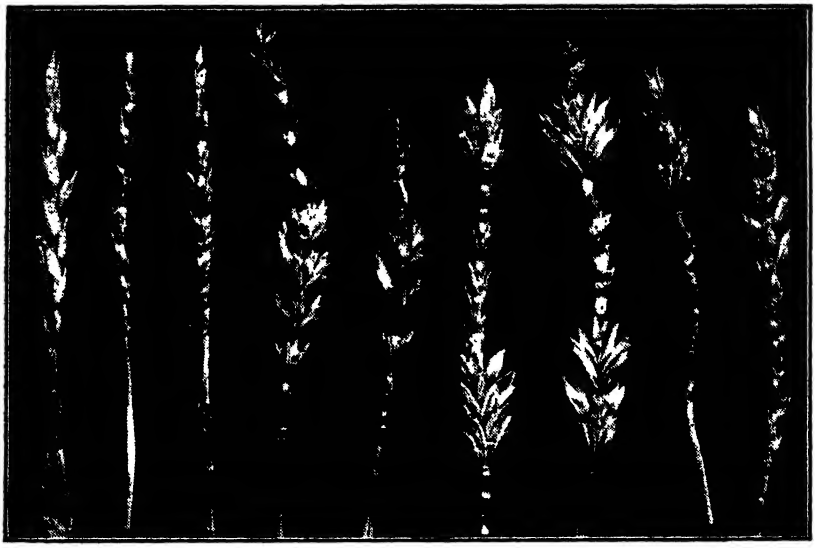


Fig. 1.—Various forms of frost injury of Wheat Heads.

Head on left completely bleached and empty. Next two heads show malformation of all their spikelets. The following pair are malformed at the tops only. The next one is malformed only in the middle region. Its neighbour is malformed at the top as well as in the middle. The last two (on the right) are malformed only at the base.

Photo. by Government Printer.

(b) *Leaf Injuries.*

There does not appear to be anything very characteristic about the symptoms of wheat leaves affected by frost, the injuries closely simulating in appearance the dying back of the leaves from the tips so often brought about in this State by hot drying winds or dry soil conditions or both combined. The leaf blades are frequently killed back and browned from the tips for about one-half of their length, although rare instances have been seen in which the injury had taken place right down the leaf sheath to its parent node.

Wheat plants seem to be most susceptible to frost injury at, or about, flowering time, *although many plants have been seen severely injured, both on the leaves and stems, long before the plants came out into ear.*

(c) *Stem Injuries.*

Frost injury of wheat stems may be indicated by a more or less conspicuous white ring encircling the stem a variable distance below the wheat head, but above the point where the true stem emerges from the topmost leaf sheath. Each ring may be about an inch in length or less and two such have occasionally been observed on the one stem separated by normal green tissue. (See Fig. 2.)

A more usual type of stem injury is a blistering or "silvering" of the skin (or epidermis) at, or in the neighbourhood of, the joints (or nodes) at various places along the stem. This silvering effect, which is due to the formation of very

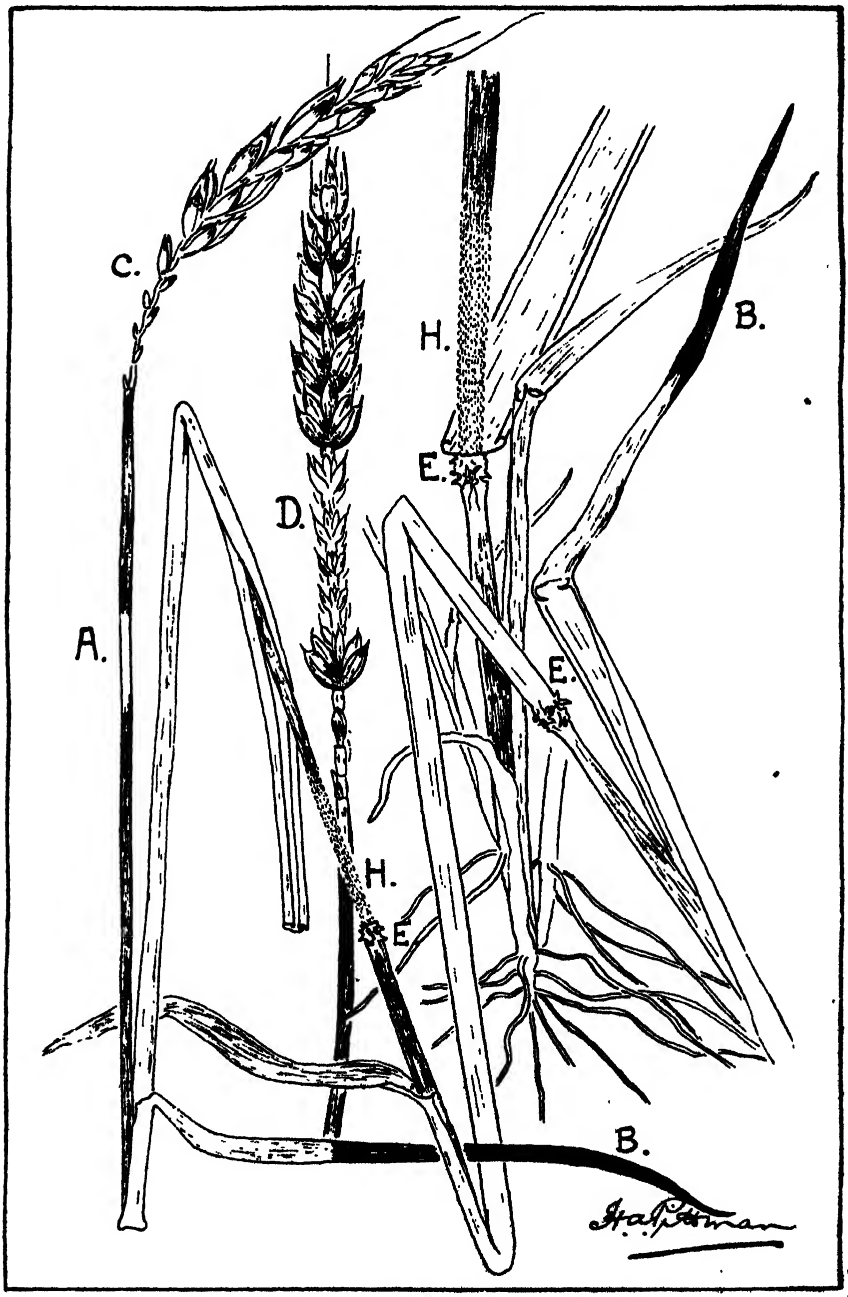


Fig. 2.—Various forms of frost injury on Wheat.

A. White ring on stalk between wheat head and topmost node. B. End of leaf killed back by frost. C. Unusual bareness at base of wheat head, due to frost injury. D. Malformation of wheat head, due to frost injury. E. Blistering, cracking, and rupturing of the epidermal tissues (skin) of the node or joint. H. Blistering and silvering of the epidermal tissues of the stem for a considerable distance above the node.

A, D, E, and H are reliable diagnostic characters of frost injury.

numerous minute puckerings or blisters in the epidermal tissues so that small air spaces are formed below them, is most frequently met with on the stem on the upper side of a node and only rarely on the lower side. It often extends up the stem above the node for a couple of inches or even more in rare cases. Associated with the formation of these minute blisters above the node region are often quite extensive cracks, ruptures, and blisters in the epidermis (skin) of the node itself. The "silvering" of the internodal tissues and cracking of the nodes as just described are not, in the vast majority of cases, to be observed except by pulling away the surrounding leaf sheath, which is usually quite uninjured. They are both positive indicators of frost injury and should always be looked for where such injury is suspected. The absence of these symptoms does not, however, indicate that frost injury has not occurred to other parts of the plant.

Cases are frequently found where the stem tissues for a couple of inches above a node and sometimes also below a node, have been transformed from the normal green colour into a brown silage-like colour. This symptom, which may occasionally be shown by the surrounding leaf sheath, is often due to frost. In such cases if the stem is split open, a dark reddish-chocolate-brown colour will sometimes be found lining the cavity of the stem in the region corresponding to the external injury. On the other hand cases have been seen where this brown discolouration was found inside the cavity of the stem without any discolouration being present outside. The "silvering," node cracking and silage-like lesions are frequently found at or near the topmost node of the stem, but any node may be the location of the injury and several injured areas are frequently found at different places on the one stem. Sometimes a longitudinal crack occurs down an affected internode. (An internode is the portion of the stem between two joints or nodes.)

Nodes blistered, cracked or ruptured as described above, often take on a dark colour wholly or in part, presumably owing to parasitic infection of the already injured tissues.

Sometimes the nodes are shrunken as if dried out and the epidermal tissues on either side of a node may have a tightly drawn and bleached appearance. A shiny brown discolouration apparently due to frost injury is often found on the stem extending downwards below the first node above ground level. This discolouration can usually be distinguished from similar stainings due to such a parasitic disease as "Foot-rot," for example, by the fact that the extreme bases of the stems and the root symptoms of the frosted plants are usually quite white and free from any indication of parasitic infection.

Frost-affected stems frequently fall over (lodge) near the first node above ground level. Many may break completely away from the plant. Should they not break off, they may eventually bend up into a vertical position again at an uninjured node and develop fairly satisfactory heads, provided the male and female structures have not been injured by the same or succeeding frosts. "Second growth" (late tillering) is often very well developed on wheat plants severely injured by frost on the original main stems.

Factors affecting Frost Injury of Wheat Crops.

A study of correspondence and inquiries at this office concerning frost injury to wheat crops from the beginning of 1930 onwards, as well as reports of extensive field observations made by Agricultural Adviser G. L. Throssell, especially in the North-East and adjacent wheat areas, suggests that frost injury is most serious in wheat crops planted on an insufficiently consolidated soil. Crops grown on soils which are naturally light or of a fluffy nature such as morrell and kopi (Esperance wheat area) are apparently most subject to serious injury. Many farmers

have reported that their crops of the same variety planted at the same time on adjoining salmon gum and gimlet soils have either not been affected at all, or have not been affected to anything like the same extent on these heavy soils as on the neighbouring lighter land.

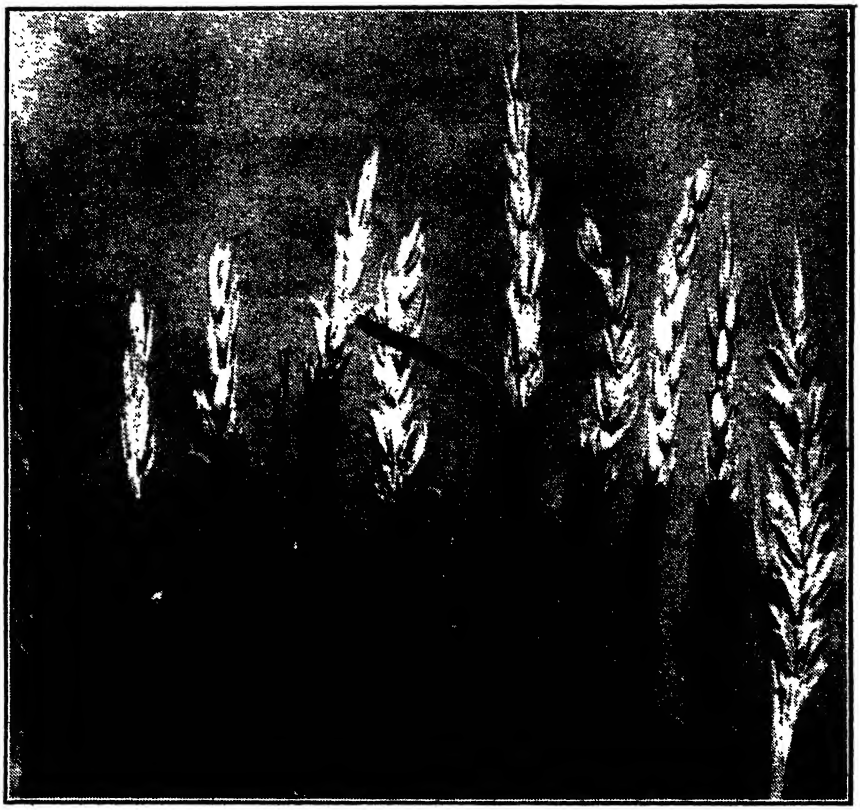


Fig. 3.—Wheat Heads showing the effects of hot drying winds at, or about, the flowering period.

The head on the extreme left is normal, that on the extreme right completely whitened and empty; all the others are "tipped," *i.e.*, whitened and free of grain for a greater or less portion of the terminal part of the head. Wind injury never occurs at the middle or base of a wheat head without also similarly affecting all the more terminal portions of the head, whether frost often does. This feature is often of considerable diagnostic value in distinguishing wind injury from frost injury. See Bulletin 301.

Photo. by Author.

Severe losses have occurred at times, however, on heavy soil where the seed-bed has not been sufficiently consolidated (by appropriate cultural practices, etc.) before seeding time. This seems to be particularly the case in newly cleared land where the crop has been "scratched in" on the burn or even where planted after one year of fallow following clearing. Other things being equal, the susceptibility to frost injury appears to decrease with subsequent cropping. (For similar evidence *re* the association of wind injury to wheat heads at or about flowering time and lack of consolidation of the seed-bed, see Bulletin 301.)

From information available frost injury appears to be more severe in the neighbourhood of growing timber than farther away. It is usually more serious in low-lying places than on the higher land in the vicinity. Slopes facing East seem to be more severely affected than those facing in other directions.

There is some indication that frost injury may be more serious on salty soils than on those not so affected. It has been observed by Agricultural Adviser G. L. Throssell that in some districts where frost injury has been exceptionally severe the plants have shown the bluish tinge often indicative of a salt problem.

Another factor which appears to be of importance is the time of planting. Crops planted earlier than has so far been found most suitable for that variety in the particular district concerned, seem to have been more seriously injured than those planted within the "correct" period.

Economic Importance of Frost Injury to Wheat Crops.

It is impossible to form any accurate estimate of the losses due to the ravages of frost in Western Australian wheat crops owing to the absence of any sufficiently extensive careful field surveys. From field observations, however, Agricultural Adviser G. L. Throssell considers that frost has so far caused greater economic loss to the farmers of the North-Eastern and Esperance wheat areas than any other wheat disease.

Almost all the centres from which frosted wheat plants have been received are located in the early zone of the Wheat Belt, and the areas most frequently submitting such specimens are those comparatively close to its most inland limits, such as the Northern portion of the Esperance wheat area, the Yilgarn, and the North-Eastern wheat area.

Varietal Susceptibility to Frost Injury.

Variation being, so it is said, "the most invariable thing in nature," it is to be expected that varieties will vary in their susceptibility to frost injury just as they do in morphological characters (appearance) and physiology (rate of maturation, chemical composition of the grain, and other "functional" activities). However, there is no reliable evidence at hand as yet as to any variation in this respect.

Control.

From what has been said above, the following control methods suggest themselves:—

1. Thorough consolidation of the seed-bed by seeding time so that there is a firmly compacted seed-bed on to which the seed can be placed about 1¼ to 1½ inches below the surface mulch.

2. "Seasonable sowing," that is the planting of each variety, when possible, in the period which has been found by experiment to be the most suitable for that variety in the district concerned. Moreover, the seed should be planted as near to the end of the permissible seeding period as possible. This also assists in the control of "Take-all" and "Flag Smut." (See Leaflets 119 and 160.)

3. The feeding off or cutting back of crops becoming too forward and rank owing to either (a) having been planted too early, or (b) the advent of unusually mild weather conditions during the early part of the growing season, or (c),—(a) and (b) combined. This is important also for the prevention of the "septoria," "dry blight," or "glume blotch" disease caused by ***Septoria nodorum*** which is essentially a disease of crops coming into ear too early in the season.

4. The planting of those varieties in very frost liable districts, which experience eventually shows to be the least susceptible.

CONTROL OF "BLACK SPOT" OR "SCAB" OF PEARS IN WESTERN AUSTRALIA.

By JOAN HEARMAN, B.Sc.

The "Black Spot" disease of pears due to the fungus *Venturia pirina* (Aderhold) is the cause of serious economic loss in W.A. The following paper records the first attempt to study the disease in any detail in this State.

The author is indebted to Mr. H. A. Pittman, B.Sc. (Agr.), Plant Pathologist of the Department of Agriculture of W.A. and Lecturer in Plant Pathology at the University of W.A., and to Mr. W. M. Carne, Senior Plant Pathologist of the Council for Scientific and Industrial Research, for suggestions as to what particular problem of outstanding economic importance might be investigated in order to gain some experience of research work in plant pathology. Messrs. W. Sounness and Sons, "Merryup," Mt. Barker, were approached, and they readily agreed to allow their orchard to be used for the experiments. To them my thanks are due for their unfailing interest and co-operation without which the experiments on the control of the disease could never have been successfully carried out. The experiments were conducted under the general supervision of Mr. Pittman, whose help and

Fig. 1.

Williams Bon Chrietien or Bartlett pears badly affected with "Pear Scab" or "Black Spot" due to *Venturia pirina.*

After H. A. J. Pittman, This Journal, June, 1930.

advice throughout the carrying out of the work and its preparation for publication has been of inestimable value. Thanks are also due to Mr. H. A. Turner, of the Department of Agriculture, Tasmania, and to Dr. W. J. Dowson, late Plant Pathologist of the same department, for information conveyed in correspondence concerning their work on this disease in Tasmania. The work was carried out as part of the requirements for an Honours degree in Botany in the University of W.A. Thanks are due to Professor G. E. Nicholls and Mr. E. W. Bennet for the loan of apparatus and for kindly criticism of the text.

The author is greatly indebted to the Department of Agriculture of W.A. which has rendered every possible assistance, and especially to the Director of Agriculture (Mr. G. L. Sutton) for the publication of this paper.

INTRODUCTORY ACCOUNT OF THE LIFE HISTORY OF THE FUNGUS.

The economic losses due to "Black Spot" of pears are the result of the growth within the infected tissues of the causal fungus, and the eventual production of the summer spores (or seeds), known as *Fusicladium pirinum,* in dark velvety masses on the fruit, leaves, and young twigs. These spores spread the disease during the summer. They are produced from a *mycelium* (the thread-like body of the fungus), which lives just below the surface of the leaves, twigs, and fruit. When the infected leaves fall in the autumn this *mycelium* penetrates the deeper tissues of the leaf and produces fruit bodies, known as *perithecia,* which mature by the following spring, when they produce a different type of spore called *ascospores,* which infect the developing leaves and fruits with the disease.

AIMS OF THE EXPERIMENTS.

The experiments were designed to determine—

(i.) Whether the disease could be controlled even in an orchard where it was causing very severe loss of the fruit annually.

(ii.) The primary source of infection in the spring.

(iii.) The effect of ploughing under the over-wintered leaves before the buds burst in the spring.

(iv.) How long the over-wintered leaves continue to be a source of infection when buried during the spring.

(v.) When over-wintered leaves first discharge *ascospores.*

(vi.) What weather conditions control the discharge of *ascospores.*

(vii.) For how long the discharge of *ascospores* may continue.

(viii.) The value of early ploughing alone as a control.

(ix.) The value of spraying alone as a control.

(x.) The value of early ploughing along with an extensive spray programme as a control of the disease.

(xi.) The relative value of Bordeaux Mixture and Lime Sulphur as sprays for the control of the disease.

(xii.) Whether each of these sprays would be equally effective on the two pear varieties Beurre Bosc and Glou Morceaux.

(xiii.) To what extent the disease would spread from diseased to healthy trees.

(xiv.) The value of autumn spraying in controlling the disease.

THE EXPERIMENTAL PLOTS.

The orchard proved to be ideal for the experiments, as the trees were very severely infected. Beurre Bosc and Glou Morceaux, both varieties which are very susceptible to the disease, were available for the experiments. In May, 1932, 96 per cent. of the leaves on the Beurre Bosc trees, and 100 per cent. of the Glou Morceaux leaves showed "Black Spot" lesions. This estimate was made by picking hundreds of leaves off the trees at random and then examining them for "Black Spot" lesions on the blade and petiole. Wood lesions were plentiful, especially on the young wood. No conclusive evidence could be found that the two year old wood had living lesions, and no *Fusicladium* spores were obtained from wood of this age. Of the young wood on the Beurre Bosc trees 69 per cent., and of the Glou Morceaux wood 62 per cent., showed lesions in May, 1932. This estimate was made by counting the total number of young twigs on any branch, and then

counting the number of those twigs showing lesions. The 1931-32 crop had been a heavy one, but only a small percentage of it had been marketed owing to the ravages of the disease. These estimates show that the disease was acute on these two varieties.

In these experiments 310 *trees were used.* They were divided into two blocks.

Block I.—38 *trees—land unploughed*—35 *trees unsprayed.*

Block 1 consisted of 38 Glou Morceaux trees, and was not ploughed till December 7th, 1932. It was left unsprayed, except for three trees at the south-west corner which were sprayed with Bordeaux Mixture once in the early "pre-pink" stage. These three trees will be referred to as plot D.

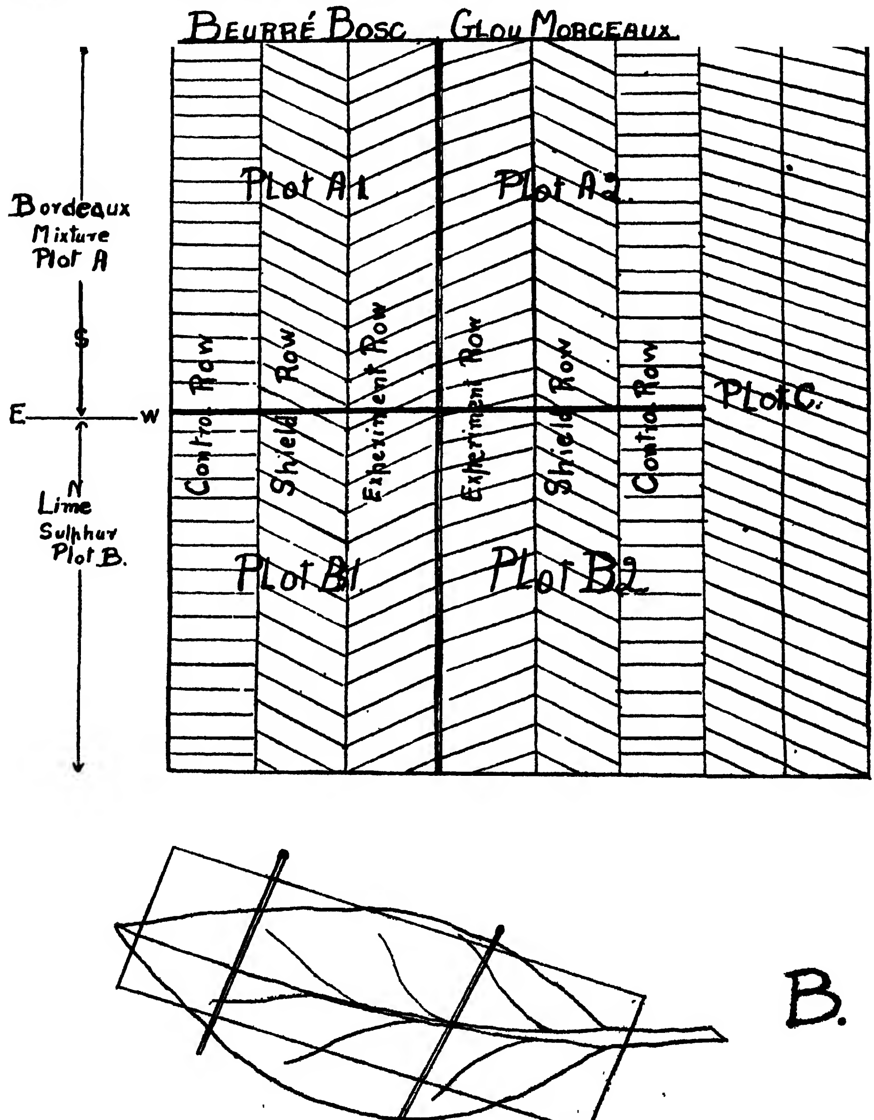


Fig. 2.
A. Plan of Block 2, Experimental Plots at "Merryup," Mt. Barker, W.A.
B. A microscope slide over a pear leaf as used to trap discharged ascospores.

Block II.—272 trees—land ploughed—204 trees sprayed—68 trees unsprayed.

Block II. (Fig. 2) was ploughed early,* and consisted of eight rows of 34 trees to a row, the rows running north and south. The three rows on the east side of the block were Beurre Bosc, while the five on the west were Glou Morceaux. The two westernmost rows of Glou Morceaux will be known as plot C. Of the six remaining rows the four centre rows received the full treatment, while the two outside rows were left unsprayed as controls. Of the four inner rows the southern half was treated with Bordeaux Mixture, and is known as plot A, while the northern half was treated with Lime Sulphur, and is known as plot B. Of these six rows the two innermost are known as experiment rows, the next two, working outwards, as shield rows, and the two outside rows as control rows. Plot C received the same spray treatment as plot A, but in addition it received an extra application of Bordeaux, 3-4-50, on December 13th, 1932.

AUTUMN SPRAYING.

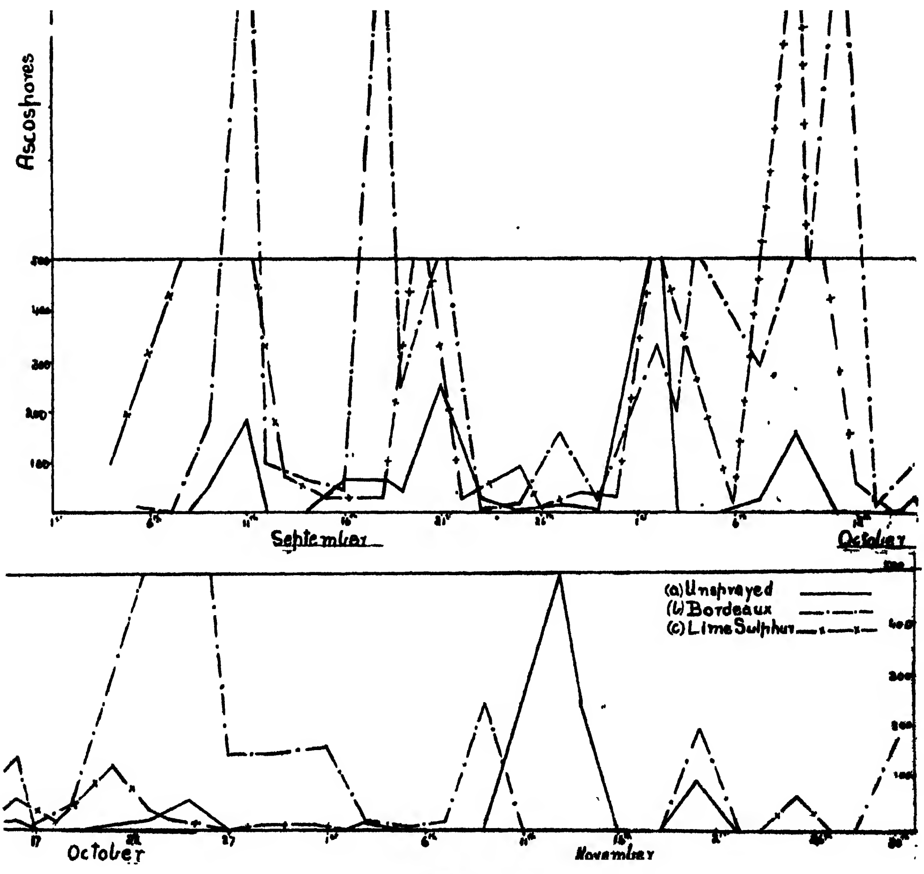
An autumn spraying of plot A I. and plot A II. (Fig. 2) shield and experiment rows with Bordeaux Mixture 6-4-50 was given on 23rd April 1932. The shield and experiment rows of plot B I. and B II. were sprayed with Lime Sulphur 1 to 15 on 25th April, 1932. It was subsequently found that leaves sprayed with either Bordeaux or Lime Sulphur in the autumn gave off more *ascospores* in the spring than those which were not sprayed. This was a somewhat unexpected observation, and this conclusion was drawn from the following experiment. In the autumn (30th April) six series of leaves (unsprayed, sprayed with Bordeaux, and sprayed with Lime Sulphur, from each of the two varieties) were collected, all with visible lesions. They were left in the orchard throughout the winter, under approximately natural conditions, being placed on soil in boxes and covered with wire netting to keep them in place. On 25th August three leaves from each box were placed on the ground in the orchard, and each leaf was covered with a slip of glass (a 3in. x 1in. microscope slide) supported by matches (Fig. 2B). The glass was smeared on the under surface with glycerine to collect the discharged spores. During September, October, and November a fresh slide was substituted every forty-eight hours, and a count was made of the number of spores adhering to the slide, except in cases where there were too many to count. In these cases spores were counted to five hundred, and are recorded as five hundred plus. In this manner a record of the total number of *ascospores* discharged from each of these eighteen leaves during this period was obtained. It is assumed that the number of spores adhering to the slide bore a constant relation to the total discharge. The observations commenced on 26th August and *the initial discharge took place on 4th September*. From this date some spores were observed on the slides each day, so the *discharge of ascospores was continuous for three months.*

Graphs I. and II. indicate that more spores were discharged from the leaves which were sprayed in the autumn than from those which were not sprayed, suggesting that the autumn spraying was actually harmful in this case. It must be remembered, however, that the leaves were heavily infected when the spray was applied, and that a spray is only a preventive measure. If the leaves had been free of disease, or fairly so, after the fruit was picked, immediate spraying might have prevented the fresh outbreak of the disease, which occurred with the onset of the autumn rains. This result is only that of one experiment on "Black Spot" of pears, and does not invalidate the general principle that an autumn spraying is, as a rule, helpful for the control of fungal diseases of fruit trees.

* The land was ploughed towards the trees on either side, the first furrows lapping, leaving to all intents and purposes no leaves uncovered, thus obviating the necessity for digging around the trees.

These graphs also show that more *ascospores* were discharged from the Beurre Bosc leaves than from the Glou Morceaux leaves in spite of the fact previously noted that not quite such a large percentage of the former showed the disease in the previous autumn. At the time of the leaf fall the majority of the lesions on the Beurre Bosc leaves were old, and few *Fusicladium* spores could be obtained from them. On the other hand, most of the lesions on the Glou Morceaux leaves were relatively young. They looked light brown, and were very thickly scattered over the under surfaces of the leaves. *Fusicladium* spores could readily be obtained from these lesions. It would appear from these observations that the later infect'ons did not produce so many *perithecia* as the older infections.

An attempt was made to investigate this point as follows:—Unsprayed Beurre Bosc and Glou Morceaux leaves were boiled in caustic soda (5 per cent.) to render



Graph I.

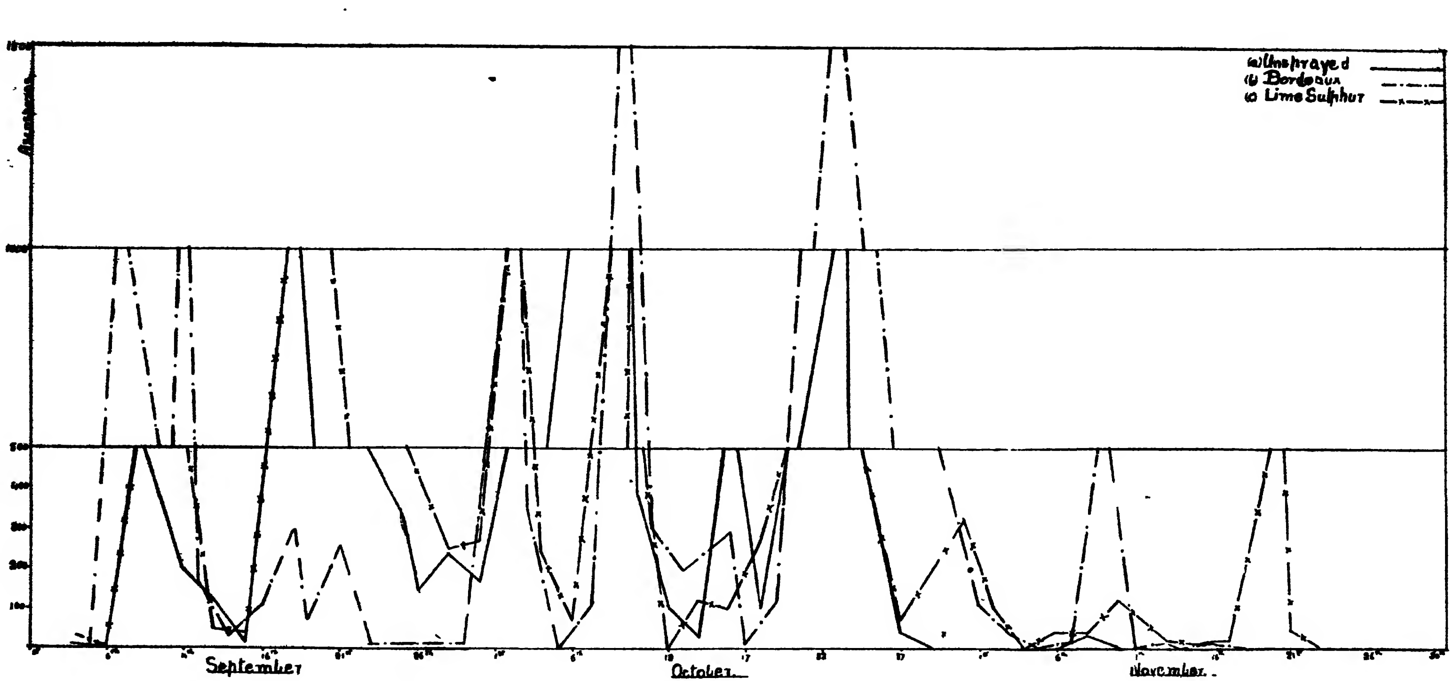
Graph of the *Ascospore* discharge from Glou Morceaux leaves during September, October, and November, 1932, at "Merryup," Mt. Barker—

(a) the total discharge from three unsprayed leaves;

(b) from three sprayed with Bordeaux Mixture; and

(c) from three sprayed with Lime Sulphur.

The sprayings in each case were given in the previous autumn.



Graph II.

Graph of the *Ascospore* discharge from Beurre Bosc leaves during September, October, and November, 1932, at "Merrylup," Mt. Barker—
(a) The total discharge from three unsprayed leaves;
(b) from three sprayed with Bordeaux Mixture; and
(c) from three sprayed with Lime Sulphur. Both these sprayings were given in the previous autumn.

the tissue of the leaf gelatinous and leave the *perithecia* clearly exposed to view. (This method was used by Nicholls (1913), and the author is indebted to Mr. Turner, of the Department of Agriculture, Tasmania, for drawing attention to it.) The areas of pieces of treated Beurre Bosc and Glou Morceaux leaves were measured and a count was made of the total number of *perithecia* in that area. By this means an average of the number of *perithecia* per square millimeter of leaf surface was arrived at. The result is set out in the following table, and is not at all conclusive:—

TABLE OF THE AVERAGE NUMBER OF PERITHECIA PER SQUARE MILLIMETRE OF LEAF SURFACE.

Date.	Beurre Bosc.	Glou Morceaux.
June	2·4	2·25
July	3·5	4·5
August	5·5	...
September	3·7	5·3
November	4·3	3·0
February	5·0	4·4

This experiment was repeated, using leaves sprayed with Lime Sulphur and with Bordeaux Mixture in the autumn, and leaves which had not been sprayed. The following results were obtained:—

TABLE OF AVERAGE NUMBER OF PERITHECIA PER SQUARE MILLIMETRE OF LEAF SURFACE IN SPRAYED AND UNSPRAYED LEAVES.

<table>
<tr><th>Date.</th><th>—</th><th>Unsprayed.</th><th>Lime Sulphur</th><th>Bordeaux.</th></tr>
<tr><td rowspan="3">June, 1932 ...</td><td>Average No. per sq. mm. ...</td><td>2·7</td><td>3·2</td><td>1·2</td></tr>
<tr><td>Average diameter ... ...</td><td>39 μ</td><td>46 μ</td><td>39 μ</td></tr>
<tr><td>Range ... ...</td><td>14-65 μ</td><td>21-73 μ</td><td>29-58 μ</td></tr>
<tr><td rowspan="3">July, 1932 ...</td><td>Average No. per sq. mm. ...</td><td>3·7</td><td>4·5</td><td>3·8</td></tr>
<tr><td>Average Diameter ... ...</td><td>51 μ</td><td>61·7 μ</td><td>56 μ</td></tr>
<tr><td>Range ... ...</td><td>21-73 μ</td><td>21-98 μ</td><td>14-87 μ</td></tr>
<tr><td rowspan="3">August, 1932 ...</td><td>Average No. per sq. mm. ...</td><td>5·7</td><td colspan="2">5</td></tr>
<tr><td>Average Diameter ... ...</td><td>74 μ</td><td colspan="2">62 μ</td></tr>
<tr><td>Range ... ...</td><td>29-122 μ</td><td colspan="2">29-87 μ</td></tr>
<tr><td rowspan="3">February, 1933</td><td>Average No. per sq. mm. ...</td><td>4</td><td>4</td><td>5</td></tr>
<tr><td>Average Diameter ... ...</td><td>107 μ</td><td>105 μ</td><td>102 μ</td></tr>
<tr><td>Range ... ...</td><td>45-183 μ</td><td>61-168 μ</td><td>45-183 μ</td></tr>
</table>

PRUNING.

The second step in the control programme adopted concerns the pruning of the trees. It was assumed that the lesions on the wood might remain alive during the winter, and with the onset of spring weather produce more *conidiospores*, which would be a source of primary infection of the young leaves, twigs and fruits in the spring. The young wood was so heavily infected (between 60 and 70 per cent. of the shoots showing lesions) that it was impossible to prune out all the infected wood without considerably harming the trees. This difficulty was partially overcome as a

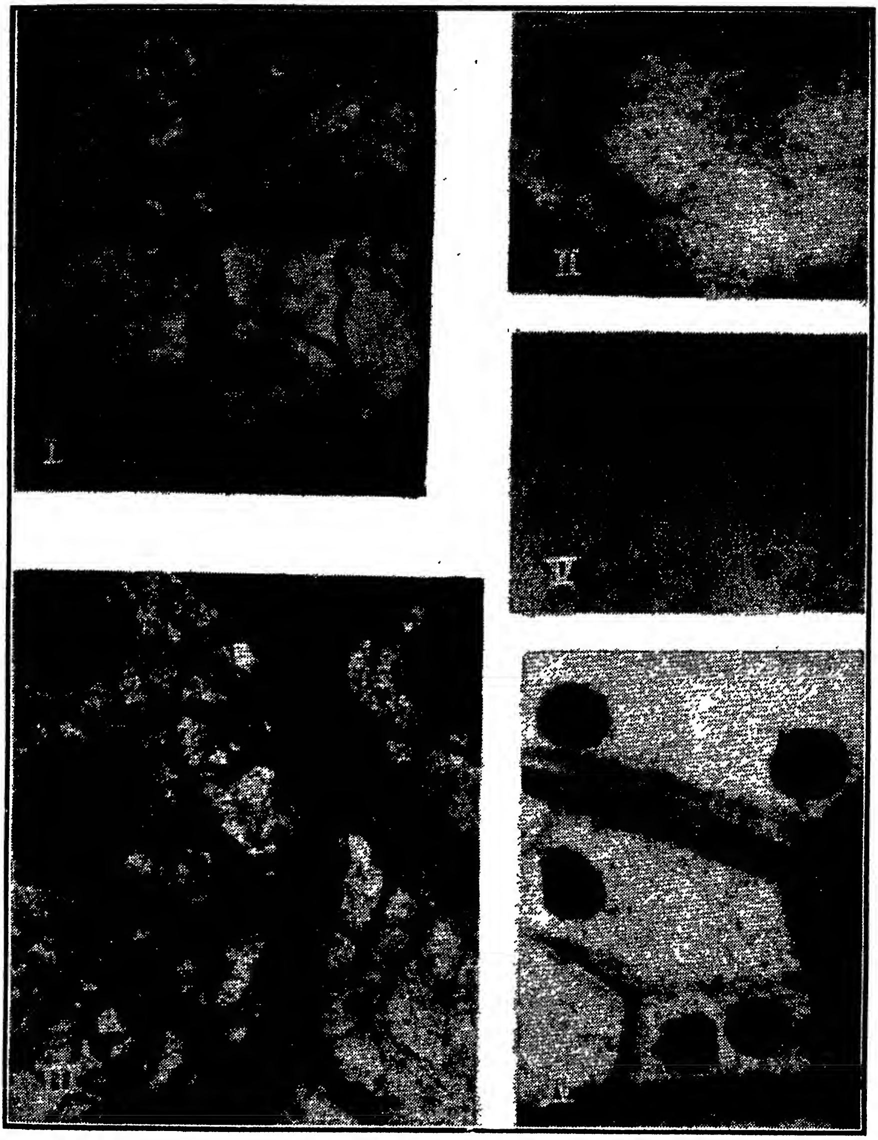


Fig. 3.—Microphotographs of *Venturia pirina* in pear leaves.

I. *Mycelium* in early stages of *perithecial* formation in Glou Morceaux leaf in July. Note knotting of *mycelium*. Mag. × 280.

II. Another photograph from the same microscope slide. Note knotting of *mycelium*. Mag. × 140.

III. Immature *perithecia* with *mycelium* in a Beurre Bosc leaf in September. Mag. × 140. (Bottom left-hand corner of block.)

IV. A group of mature *perithecia* in a Glou Morceaux leaf in September. The *ostioles* are prominent and are surrounded by a dark ring of bristles. The *mycelium* has largely disappeared. Mag. × 80. (Bottom right-hand corner of block.)

V. The stripped *epidermis* of a Beurre Bosc leaf with a young *Fusicladium* lesion showing the *conidiophores* in April. Mag. × 140.

These microphotographs are from microscope slides prepared by the caustic soda method.

Photos. by author.

result of an observation made by Mr. Sounness in previous years, that the pears on the outside of the trees which hung down away from the leaves were less diseased than those which grew in the centre of the trees. This might perhaps be attributed to the inability of the fungal spores to germinate without water, the pears which hang clear of the leaves being protected in some measure by being more rapidly dried after rain than those in the centre of the tree, which are sheltered by leaves. In pruning the trees an attempt was accordingly made to remove as much diseased wood as possible without undue severity, and to do so in such a way as to open out the trees and let in the sun and air, and at the same time force the fruit to the lower sides of the limbs, so that it would hang free of the leaves. The trees were pruned at the end of August, except those of Block I., which were pruned about six weeks earlier. All the trees in the orchard were similarly pruned, so that this factor was constant throughout the experiment.

EARLY PLOUGHING.

The third measure in the control programme was an early ploughing. In planning the experiments it was assumed that the leaves from the previous year would be a source of fresh infection in the spring. The early ploughing was an attempt to get rid of this source of infection by burying the fallen leaves before the new ones developed.

Block II. (fig. 2) was situated in the midst of twenty acres of pear orchard. The whole of this orchard (including Block II.) was ploughed five inches deep. The ploughing commenced on August 30th, and was finished by September 3rd. Block I., which was left unploughed as a control, was situated about fifty yards from the rest of the pear orchard and was separated from it by some apple trees. The situation was comparable in every way. No further cultivation was carried out till November 9th., when Block II. was harrowed, two ways, with tyne harrows. After this it was worked again with disc harrows, which were followed by spring-toothed harrows. At the end of this cultivation there was a splendid loose tilth on the top, no weeds, and plenty of moisture just below the mulch. Cultivation was delayed in this manner for fear of exposing the leaves which it had been the aim of the early ploughing to bury. Not many leaves seemed to be turned up during this cultivation. On December 19th Block II. was cultivated with weeders and again on January 19th, 1933. It was cross-ploughed away from the trees on February 10th, 1933, and after this ploughing the whole orchard was worked with tyne harrows. The orchard received a dressing of blood and bone manure, 160 lbs. to the acre, after the first ploughing. The unploughed block was similarly manured at the same time.

INCIDENCE OF THE DISEASE.

The relation between the commencement of *ascospore* discharge and the bursting of the buds on the pear trees is now briefly discussed.

The first *ascospore* discharge did not take place till September 4th. The trees on the unploughed block began to move about September 13th, a few buds were bursting by September 16th, and by September 23rd they were coming into leaf. By September 30th these leaves showed the *Fusicladium* stage plentifully. On September 24th the Glou Morceaux and Beurre Bosc trees of Block II. (ploughed) were beginning to move. The Beurre Bosc were behind the Glou Morceaux, and the trees sprayed with Bordeaux Mixture in the autumn were behind those which were not sprayed and those which were sprayed with Lime Sulphur. There was no difference between the trees sprayed with Lime Sulphur and those left unsprayed in the autumn. By September 28th the Glou Morceaux of Block II. were at the "green-tip" stage. The Beurre Bosc trees came out very unevenly, but by October

3rd the fruit buds were in an early "pre-pink" condition, and the leaf buds had hardly started to move.

BUD BURSTING DATES.

Variety.	Date.	Stage
Glou Morceaux (Block I.)	September 13th ...	Buds moving
Glou Morceaux (Block I.)	September 16th ...	Buds bursting
Glou Morceaux (Block I.)	September 23rd ...	In leaf
Glou Morceaux (Block II.)	September 24th ...	Buds moving
Beurre Bosc (Block II.)	September 24th ...	Buds moving
Glou Morceaux (Block II.)	September 28th ...	"Green-tip"

The *Fusicladium* stage was first noted on Block I. (unploughed) on September 30th, and did not appear on the unsprayed trees of Block II. (ploughed) till October 17th, when one infected leaf was found on an unsprayed Beurre Bosc tree. On October 24th there was a general outbreak of the *Fusicladium* stage throughout the ploughed plot. The Beurre Bosc trees showed more *Fusicladium* lesions at first than the Glou Morceaux. The disease first appeared on the under surfaces of the leaves, but on October 25th it was showing plentifully on the young Beurre Bosc fruit. The Glou Morceaux trees on Block II. were in flower at this date, the disease being very plentiful on the under surfaces of the leaves.

RESULT OF EARLY PLOUGHING.

The percentage infection of the fruit was estimated by counting the total number of pears in a cluster, and then the number of these which were diseased. The trees on the unploughed plot flowered and set their fruit just as well as those on the ploughed plot, but before the pears were the size of a marble the stalk *became so badly infected with the disease that it withered and the whole crop fell off,* with the exception of that on the three trees which were sprayed once with Bordeaux. The unsprayed trees on the ploughed plot (Block II.) set just as good a crop as the sprayed trees, but by November about 77 per cent. of these pears were diseased; and by February there were no pears on these trees which were free of disease, and no marketable fruit was obtained from them. In this experiment, therefore, *ploughing before the buds burst prevented the disease from causing the whole crop to fall before maturity, but it did not prevent 100 per cent. of the fruit from showing the ravages of the disease.* However, it can be recognised as quite a valuable measure in a programme for controlling "Black Spot" of pears in this State.

TABLE OF PERCENTAGE OF INFECTION OF FRUIT ON UNSPRAYED TREES.

Date.	Block II. (Ploughed).		Block I. (Unploughed).
	Beurre Bosc.	Glou Morceaux.	Glou Morceaux.
September 30th ...	0 per cent.... ... (Not flowering) ...	0 per cent.... ... (Not flowering) ...	Showing on leaves. (Not flowering.)
October 28th ...	37·8 per cent. ...	60 per cent. ...	80 per cent.
November 2nd ...	77 per cent. ...	77 per cent. ...	No pears left on trees.
February 20th ...	100 per cent. ...	100 per cent. ...	No pears left on trees.

A further experiment to gauge the efficiency of early ploughing in destroying the source of infection in over-wintering leaves, and also to find which type of spore, the *ascospore* from the over-wintered leaves, or the *conidiospore* from the wood

lesions, was chiefly responsible for the primary infection in the spring, was carried out. Microscope slides were smeared on one side with glycerine, and hung in the trees, glycerine side down because of the rain. Three slides were hung in unsprayed trees on the unploughed plot, and two in unsprayed, and one in a sprayed tree on the ploughed plot. The following are the results obtained from a periodical examination of these slides:—

TOTAL SPORES FROM PLOUGHED AND UNPLOUGHED PLOTS.

Date.	Ploughed Plot (3 slides).				Unploughed Plot (3 slides).	
	Conidiospores.		Ascospores.		Conidiospores.	Ascospores.
September 14th	0		0		0	0
September 21st	0		5		4	17
September 30th	0		0		2	12
	Sprayed (1 slide).	Unsprayed (2 slides).	Sprayed (1 slide).	Unsprayed (2 slides).		
October 6th	7		7	28	12	175
October 21st	7		12		75	229
November 4th	49	738	2	11	Thousands	7
November 17th	98	2,306	0	4	Thousands	1
November 24th	68	563	1	0	Thousands	1
November 30th	104	1,900 +	0	0	Thousands	0
February 21st	Thousands		1		Thousands	5

No spray was applied till October 3rd in 1932 season.

These figures indicate that although infection from *ascospores* was not eliminated by the early ploughing, it materially decreased the number of *ascospores* floating in the air, thus strengthening the conclusion already drawn of the value of early ploughing as a control measure.

THE PRIMARY SOURCE OF SPRING INFECTION.

The *conidial* stage appeared on the leaves of the trees on the unploughed plot on September 30th, and on the ploughed plot on October 24th. *Fusicladium* spores were noted on leaves in a few places on unsprayed Beurre Bosc trees on the ploughed plot on October 17th. After September 30th on the slides from the unploughed plot *conidiospores* began to be plentiful, whereas before they were virtually absent. But when there were few *conidiospores* on the slides there were many *ascospores*. This seems to indicate that primary infection came from *ascospores*.

From time to time during the spring, and before the *conidial* stage was evident on the leaves, scrapings were taken from a great many twigs which appeared to have old lesions or unopened blister-like patches, and *Fusicladium* spores were never found. This confirms the conclusion drawn from the observations on the slides hung in the orchard, viz., that infection is primarily by *ascospores* from over-wintered leaves.

THE EFFECT OF BURYING OVER-WINTERED LEAVES DURING THE SPRING.

The following experiment was carried out to determine the effect on the *ascospore* discharge of burial of the over-wintered leaves, and the consequent effectiveness of the early ploughing. On August 31st, while ploughing was in progress, some of the leaves which had been lying on the ground throughout the winter were collected and buried, at a depth of five inches, at a marked spot on one of the headlands. They were dug up on November 10th and examined frequently

till the end of the month for *ascospore* discharge, using the method already described, which was in use at the same time for the observations on the unburied leaves. The latter discharged *ascospores* throughout November, and possibly later, but no discharge was found to occur in the case of the leaves which had been buried. It would appear, therefore, that infected leaves are rendered innocuous by burial for ten weeks, so that there is no danger in exposing them by cultivation after they

Fig. 4.—Stages of Apple Blossom Development.

1. "Green-tip," "delayed dormant" or "spur-burst." 2. "Tight-cluster." 3. "Open-cluster" or "pre-pink." 4. "Pink." 5. "Full-bloom." 6. "Petal-fall." 7. "Calyx-closed." *After the drawing by N. J. Adamson, in Cunningham's "Fungous Diseases of Fruit Trees."* When deciding the correct stage to apply any spray always choose the period when the *majority* of the spurs are at the stage required.

Although these drawings are of apple blossom development, they may be taken to apply in a general way to the development of pear blossoms also.

have been buried for this period. The minimum period after which cultivation can be carried out with safety was not determined.

These observations were confirmed by an examination of the *perithecia* in these buried leaves. By boiling the leaves in caustic soda (5 per cent.), as already described, it is possible to see the *perithecia* clearly. Over fifty *perithecia* were dissected from treated leaves and squashed, no *ascospores* being found. These *perithecia* were of mature size (90-100 μ) and similar in appearance to those which did contain *ascospores*.

Leaves that were turned up by the plough in August, 1932, were examined in the same way. They were found to contain *perithecia* of mature size but no *ascospores*.

These results may be interpreted as follows: leaves buried in the ground would be kept wet, so that as soon as the *ascospores* became mature conditions would favour a discharge. Leaves above the ground, on the other hand, would usually be dry for some period of the day, and these dry periods might check the discharge, the leaves accordingly continuing to discharge intermittently for a much longer period.

SPRAY SCHEDULE.

The fourth part of the control programme was a spray schedule based on that recommended by Mr. H. A. Pittman (Pittman, 1930) and is set out in the following table:—

GLOU MORCEAUX SPRAY SCHEDULE.

Date	Plot	Spray	Strength	Stage	Weather	Max. Temp.	Rel. Humidity
Sept. 28th	A2 and C	Bordeaux	5—4—50	"Green-tip"	Good drying		
Sept. 29th	B2	Lime Sulphur	1 in 15	"Green-tip"	Dull and cool		
Oct. 7th	B2	Lime Sulphur	1 in 35	Pre pink to pink	Dull, windy and cold		
Oct. 11th	A2 and C	Bordeaux	3-4-50	do. do.	Dull but dry		
Oct. 27th	B2	Lime Sulphur	1 in 50	Petal-fall	Rather hot and sunny	82° F.	49
Oct. 27th	A2 and C	Bordeaux	3-4-50	do.	do.	82° F.	40
Nov. 10th	A2 and C	Bordeaux	3-4-50	10 days after petal-fall	Sunny but cool	69° F.	54
Nov. 10th	B2	Lime Sulphur	1 in 50	do. do.	do.	69° F.	54
Dec. 13th	C	Bordeaux	3-4-50	1 month after last spray	Dry		

BEURRE BOSC SPRAY SCHEDULE.

Date	Plot	Spray	Strength	Stage	Weather	Max. Temp.	Rel. Humidity
Oct. 3rd	A1	Bordeaux	5-4-50	Early pre-pink	Sunny and windy		
Oct. 3rd	B1	Lime-Sulphur	1 in 15	do.	do.		
Oct. 24th	A1	Bordeaux	3-4-50	Petal-fall	Sunny and warm	70° F.	72
Oct. 25th	B1	Lime Sulphur	1 in 50	do.	Warm, dull with misty rain at times	62° F.	69
Nov. 3rd	A1	Bordeaux	3-4-50	Ten days after Petal-fall	Sunny but cool	69° F.	66
Nov. 3rd	B1	Lime-Sulphur	1 in 50	do.	do.	60° F.	66

The Lime Sulphur applied to the Beurre Bosc trees on October 3rd and October 25th caused a slight amount of leaf burn, but the fruit was not, at least directly, injured. No other spray injury resulted from the above programme. It is very important to note that Bordeaux Mixture was never used during rain.

In planning this spray schedule the main idea was to protect the trees from infection. Sprays are only preventive measures, and cannot cure. The young leaves can be attacked by the fungal spores as soon as the buds burst, but if the surface of these young leaves is first covered with spray, the spores, although they may still be on the leaves, cannot germinate successfully. As the leaves and fruit grow, more surface is exposed to the chance of infection, and further spray has to be applied to protect the newly developed surface. It can be seen from the above programme that, during the early growth of the leaves and fruit, spray was applied as often as was practicable.

The spray was applied at the rate of approximately two gallons per tree.

COST OF SPRAYING.

Stage.	Bordeaux.	Lime Sulphur.
	d.	d.
"Green-tip" spray cost per tree	1·13	3·12
"Pink" spray cost per tree	0·81	1·46
"Petal-fall" spray cost per tree	0·81	1·08
"Ten Days after" spray cost per tree	0·81	1·08
Total Cost of Material per tree ...	3·56	6·74

TABLE OF PERCENTAGE OF INFECTION ON EXPERIMENTAL PLOT.

Date.	Beurre Bosc (Ploughed). Un-sprayed.	Beurre Bosc (Ploughed). Bordeaux.	Beurre Bosc (Ploughed). Lime Sulphur.	Glou Morceaux (Ploughed). Un-sprayed.	Glou Morceaux (Ploughed). Bordeaux.	Glou Morceaux (Ploughed). Lime Sulphur.	Unsprayed and Unploughed.
1932. Sept. 30th ...	...	...	...	...	...	...	On leaves
Oct. 17th ..	On leaf	...	...	...	...	...	On leaves
Oct. 24th ...	On leaf	On leaf	On leaf	On leaf	On leaf	On leaf	On leaf and flowers
Oct. 25th ...	On fruit	On fruit	On fruit	Still flowering	Still flowering	Still flowering	On leaf and flowers
			Percentage on fruit.				
Oct. 28th ...	37 8%	20%	28%	60%	14%	5·7%	80%
Nov. 2nd ...	87%	39%	28%	62·7%	8%	11%	100%
*		Shield Expt. Row. Row,	Shield Expt. Row. Row.		Shield Expt. Row. Row.	Shield Expt. Row. Row.	
Nov. 19th ...	77%	22·7% 26·7%	18·4% 18%	...	... ...	... ...	No pears left on trees
Nov. 21st ...	...	... ...	... ...	77%	17·8% 27%	23% 19 4%	No pears left on trees
		This condition	was maintained	till after	Jan. 19th,	when 1in. rain	fell.
1933. Feb. 20th ...	100%	20% 30%	94% 96%	100%	18% 23%	46% 48%	No pears left on trees

The estimates of percentage infection on fruit quoted were arrived at in the following manner. The number of pears in a cluster was counted, and then the number of these that showed lesions was noted. About fifty clusters were counted from a number of representative trees in any one plot, and then a percentage was taken. The last estimate on February 20th was arrived at by counting the total number of pears on a typical tree and then the total number showing the disease. Three typical trees were counted in each row of each plot.

* From Nov. 19th the percentages of infection for the shield and experiment rows were recorded separately.

COMPARISON OF BORDEAUX MIXTURE AND LIME SULPHUR AS CONTROLS.

It can be seen from this table that the appearance of the disease on the ploughed plot was simultaneous throughout, but that the intensity of the attack was considerably modified by the use of sprays. The disease was, at first, less severe on the Glou Morceaux than on the Beurre Bosc, but later they were about equally affected. In November those Beurre Bosc trees sprayed with Lime Sulphur showed rather less disease than those sprayed with Bordeaux Mixture. This condition held till January when there were some heavy rains. After this, new lesions appeared rapidly on those trees which had been sprayed with Lime Sulphur but virtually no new lesions appeared on the trees which had been treated with Bordeaux Mixture. This showed *that Bordeaux Mixture did not lose its protective value over a period of nearly four months* whereas Lime Sulphur did.

DIFFERENCE IN SUSCEPTIBILITY OF THE TWO VARIETIES USED.

The Beurre Bosc pears were picked at the end of February but the Glou Morceaux were not picked till a month later. In February there was not much difference in the percentage of infection on the two varieties where both were sprayed with Bordeaux Mixture but the Glou Morceaux which had been sprayed with Lime Sulphur showed much less disease than the Beurre Boscs which had received the same treatment. The Glou Morceaux cannot be so susceptible to late infection.

EXPLANATION OF THE DIFFERENCE IN THE SPRAY SCHEDULE USED ON THE TWO DIFFERENT VARIETIES.

The Beurre Bosc trees received only three applications of Bordeaux Mixture, whereas the Glou Morceaux received four, yet the results are sufficiently alike to come within the bounds of experimental error. This seems to indicate that the extra spraying was of no value to the Glou Morceaux trees. However, there was no "green-tip" stage with the Beurre Bosc. The first buds to open were the flower buds on October 3rd, with the few leaves that accompany them. Therefore an earlier spraying would have accomplished nothing. With the Glou Morceaux there was a definite "green-tip" stage, when the leaf buds were opening, about September 28th, before the flower buds began to move. The "green-tip" spray protected these opening leaves from an early attack. At the time that this spray was applied, *ascospores* were being discharged from the over-wintered leaves, and a few were about on the ploughed experimental plot. The *Fusicladium* stage was already to be found on the unploughed plot where *ascospores* had been common for about ten days. The conidial stage was not found generally on the ploughed plot till October 24th, but some lesions were found on unsprayed Beurre Bosc trees on October 17th.

THE SPREAD OF THE DISEASE BY CONIDIOSPORES.

In the last two estimates of the percentage of the disease an attempt was made to find what difference there was between the percentage infection on the experiment rows and the shield rows, which latter, it will be remembered, were situated between the experiment and control rows (Fig. 2). In December the shield rows in the Bordeaux plot showed less "Black Spot" than the experimental rows, but with the Lime Sulphur plot the reverse was the case. By February the shield rows all through were less diseased than the experimental rows. This is a curious result of which there seems no obvious explanation. In some cases the figures come well within the bounds of experimental error, but it is curious that the error is constantly in one direction. The shield and experimental rows were treated identically, the spray coming out of the same barrel, and being applied simultaneously. This consistent result makes it evident that the disease did not spread

from the heavily diseased control trees to the shield rows at all, and so seems to support Dr. W. J. Dowson's view (indicated to the writer in correspondence) that the *conidiospores* (*Fusicladium pirina*) are only splashed about by rain and are not air-borne. These spores could easily be splashed from one leaf or pear to another on the same tree by rain, but could not so easily be carried from one tree to another in this fashion. This conclusion is also borne out by the results obtained from slides hung in the trees on the ploughed plot.

TABLE OF NUMBER OF FUSICLADIUM SPORES FOUND ON SLIDES HUNG IN NEIGHBOURING TREES ON THE PLOUGHED PLOT.

Date.	Beurre Bosc. Unsprayed.	Beurre Bosc. Bordeaux.	Glou Morceaux. Unsprayed.
November 4th	561	49	177
November 16th	1,017	98	1,289
November 24th	355	68	208
February 21st	Thousands	135	470

These three trees were in neighbouring rows, but the slide in the tree which showed the least "Black Spot," *i.e.*, the sprayed tree, never seemed to collect spores from the neighbouring heavily infected trees, but as this tree became more and more diseased the number of spores collected on the slide increased. Fresh slides were hung in these trees on February 20th and removed on February 24th. These slides showed practically no *Fusicladium* spores although all the trees were heavily infected at this date. During these four days no rain fell, and this may account for the lack of spores on the slides.

DETAILS OF THE PERCENTAGE INFECTION OF THE FRUIT.
20th FEBRUARY, 1933.

Variety.	Treatment.	Row.	Perfect.	Plain.	Market-able.	Un-market-able.
Beurre Bosc ...	Bordeaux in "Early Pre-pink," "Petal-fall," and "10 days later" stages Ploughed early	Experiment ... Shield ... ... Control ... (not sprayed)	% 70 80 0	% 20 12 0	% 90 92 0	% 10 7 100
Beurré Bosc ...	Lime Sulphur in "Early Pre-pink," "Petal-fall," and "10 days later" stages. Ploughed early	Experiment ... Shield ... ... Control ... (not sprayed)	3 6 0	65 59 0	68 65 0	31 35 100
Glou Morceaux...	Lime Sulphur in "Green-tip," "Pink," "Petal-fall," and "10 days later." stages. Ploughed early	Experiment ... Shield ... ... Control ... (Not sprayed)	52 54 0	29 27 0	81 81 0	18 19 100
Glou Morceaux...	Bordeaux in "Green-tip," "Pink," "Petal-fall," and "10 days later" stages. Ploughed early	Experiment ... Shield ... ... Control ... (not sprayed)	77 81 0	12 9 0	89 90 0	11 9·6 100
Glou Morceaux...	Bordeaux in "Green-tip," "Pink," "Petal-fall," "10 days later," and "one month later" stages. Ploughed early	... ...	89·6	3·8	93	6·8
Glou Morceaux...	Unploughed till late, and unsprayed	... ...	Crop failed to mature on account of the disease.			
Glou Morceaux...	Unploughed till late and sprayed with Bordeaux in early "Pre-pink" stage	... ...	29	39	68	31·6

DEFINITION OF "PLAIN" AND "MARKETABLE."

The definition of "plain" used was that laid down in the Commonwealth regulations for the export of pears, namely, that pears with "Black Spot" may be exported if the total area of the lesions on the pear will fit inside a circle of a quarter inch diameter. In the table "plain" plus "perfect" gives marketable.

A FIFTH SPRAYING WITH BORDEAUX MIXTURE.

This table shows that an additional spraying with Bordeaux 3-4-50 applied one month after the last spray was applied to the rest of the plot, increased the percentage of perfect fruit by about 10 per cent. This shows that although the protection afforded by four sprayings with Bordeaux was very much more efficient than that afforded by the same number of applications of lime sulphur, after a lapse of nearly four months; the efficiency of the Bordeaux could be improved by a later application. This last application of Bordeaux, as in every one but the first (5-4-50) was at a strength (3-4-50) which is a good deal below that which is normally used in this State, and yet it proved very efficient and did not injure the fruit as a stronger solution often does. It was not considered practicable to spray with lime sulphur at this time, as much damage to the fruit might result if a hot day followed an application. Therefore treatment with lime sulphur must perforce cease by December, in this State.

NO EARLY PLOUGHING AND ONE APPLICATION OF BORDEAUX.

The result obtained by spraying once in the early "pre-pink" stage with Bordeaux 5-4-50, on trees which were not ploughed around till December is remarkable, and speaks very well for the efficiency of Bordeaux mixture. The trees surrounding these three, failed to mature any crop at all. These trees, sprayed once, not only set a crop, but about 30 per cent. of it was free of disease, and 40 per cent., though diseased, could be marketed as "plain." This of course is not nearly an efficient enough control measure alone for practical use, but it does show what a considerable amount of protection is afforded by Bordeaux mixture. At the time the spray was applied the leaves which had been out for nearly a week, *i.e.*, those on the ends of the leaders, etc., were showing black spot lesions, so that the disease already had a hold on the trees before the spray was applied. It would appear from this result that spraying with Bordeaux mixture is a more important feature of a control programme for "Black Spot" than early ploughing. The trees which were ploughed around early set their fruit and matured it but none of it was marketable, but the trees which were left unploughed till late, but received one application of Bordeaux mixture, not only matured a crop, but about 65 per cent. of that crop was marketable. In considering a control programme for "Black Spot" the value of an early ploughing should not be under-estimated as that alone made the difference between no crop at all and a crop which matured, but was diseased.

OBSERVATIONS ON THE AMOUNT OF INFECTION ON WOOD AND LEAVES THROUGHOUT THE EXPERIMENTAL PLOT IN FEBRUARY, 1933.

Wood.—The wood on the Glou Morceaux of the unploughed block was very heavily infected; on the unsprayed trees of the ploughed plot lesions were plentiful but were not nearly as prevalent as on the unploughed plot. The Glou Morceaux trees sprayed with lime sulphur showed a few wood lesions, and some were to be found on the wood of trees which had four applications of Bordeaux Mixture, but scarcely any on trees that had the fifth application of Bordeaux Mixture.

The unsprayed Beurre Bose trees had all the young wood heavily infected with "Black Spot," and on the trees sprayed with lime sulphur hardly a twig was to be found without lesions, but the wood of trees sprayed with Bordeaux Mixture, although showing many lesions, was not so badly infected.

In each section of the experiment the wood of the Beurre Bose was more heavily infected than that of the Glou Morceaux.

Leaves.—The leaves on the trees of the unploughed and unsprayed Glou Morceaux plot were so badly infected that they looked blackened and withered even from a distance. These leaves on closer examination proved to be covered on the under surface with a fine peppering of small new light-brown and many older lesions. The unsprayed Glou Morceaux trees of the ploughed plot also showed the peppering of new lesions on the under surface. These lesions occurred on the leaves of trees sprayed with lime sulphur, and to a less extent on those trees which had had four applications of Bordeaux Mixture, and to a still less extent again on those which had received five applications of Bordeaux Mixture.

The same was found to hold throughout the Beurre Bose plots but in each case the Beurre Bose trees were more heavily infected than the Glou Morceaux. On the whole Beurre Boses seem much more susceptible to the disease than Glou Morceaux.

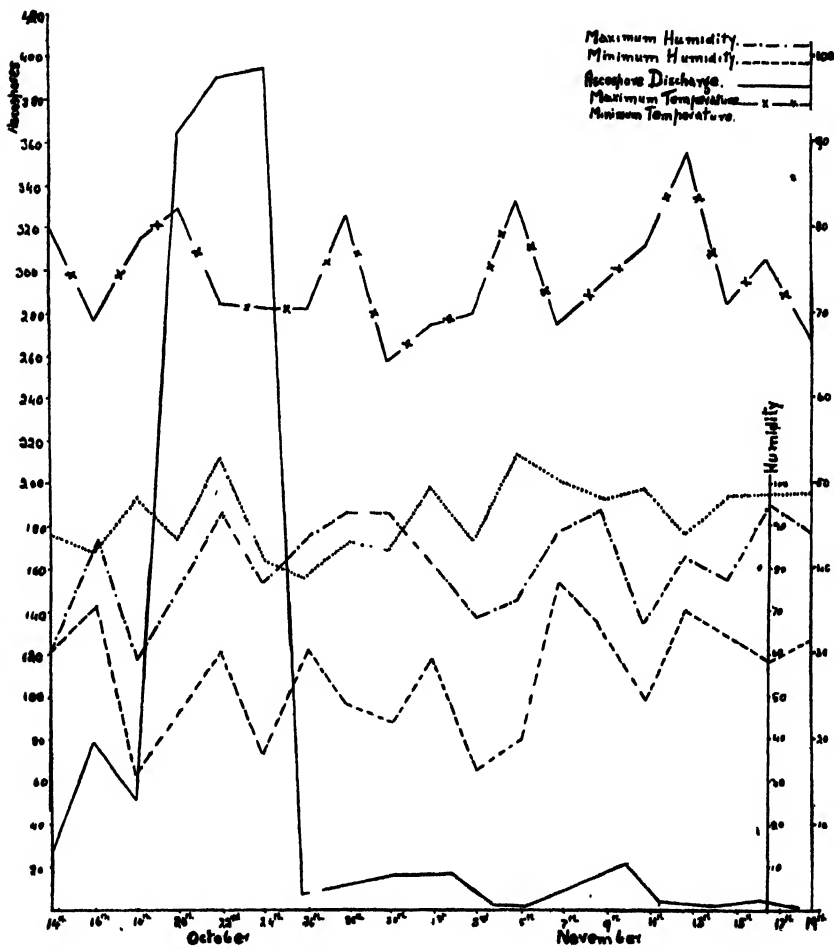
NOTES ON SPRAYING CONDITIONS AND SPRAY INJURY.

It was found that the Beurre Bose were more susceptible to injury by lime sulphur than Glou Morceaux. Beurre Bose trees were sprayed with lime sulphur 1-50 on October 25th. On October 27th, in the heat of the day (max. temp. 82deg. F.) Glou Morceaux trees were sprayed with lime sulphur 1-50. The latter suffered no ill effects in spite of the fact that it is considered dangerous to use lime sulphur if the temperature is over 75deg. F., whereas the former suffered some leaf burn during the heat of October 27th. October 25th was rough and windy in the morning but still and warm in the afternoon. Spraying was carried on all day on the Beurre Boses, and those trees which were sprayed in the afternoon did not suffer as severely in the heat of October 27th as those sprayed in the morning. When spraying in a wind, to be at all thorough, the nozzles have to be held close to the limbs, and so the spray reaches the leaves with greater force and in greater quantity. This may account for the extra burning suffered by those trees sprayed in windy weather.

NOTES ON THE CONTROL OF THE DISEASE ON OTHER VARIETIES.

In the same orchard, Duyonne du Comice, Winter Nelis, Josephine and L'Inconnue trees received a "pink" spray and a "petal-fall" spray of 3-4-50 Bordeaux mixture. The L'Inconnue and Winter Nelis, both varieties which are susceptible to the disease, at the beginning of December showed very little "Black Spot" on either fruit or leaves; this condition held till February. The orchard had of course as stated earlier, received the early ploughing treatment. Josephine is a fairly resistant variety and on the same date showed virtually no leaf lesions, but an appreciable amount of the fruit was infected. The Duyonne du Comice is also a resistant variety. One section of this variety did not receive a "pink" stage spray. This section showed much more "Black Spot" at picking time, at the end of February, than the trees which received both sprayings. The "petal-fall" spray was applied (on a windy day) to the section which

had missed the "pink" stage spray, and by December quite a number of the pears showed shiny, black, blister-like patches which have been attributed to Bordeaux burn. At picking time some of these pears were badly russetted. On these varieties a "pink" and a "petal-fall" spray with Bordeaux Mixture along with the early ploughing seem to have proved a fairly successful control programme for the disease, in this season at Mt. Barker. This result is not con-



Graph III.

Graph of average *Ascospore* discharge from six Beurre Bosc leaves, and the maximum and minimum temperatures and humidities for October and November, 1932, at "Merryup," Mt. Barker.

clusive, however, as no trees of the varieties referred to were left unsprayed as controls. However, an increase in the amount of disease present was noted when the "pink" stage spray was omitted from the treatment of the Duyonne du Comice. This indicates that the "pink" stage spraying was of value as a control measure.

THE INFLUENCE OF RAIN, HUMIDITY AND TEMPERATURE ON ASCOSPORE DISCHARGE.

Counts were taken of the number of ascospores discharged over a forty-eight hour period. A count was taken from nine leaves one day and from nine other leaves the next day, by the method described previously, from August to December. Rainfall was noted at 9 a.m. each day during this period, and a reading of the maximum and minimum temperatures, and of the humidity, was taken each day at 9 a.m. and 5 p.m. from October 15th to December.

An attempt has been made to correlate these factors with ascospore discharge. However, no correlation was found between the temperature, or the humidity, and ascospore discharge. (See Graph III.)

There is a general similarity between the graphs of ascospore discharge and the rainfall, but no very definite relation. There seems to be a peak period in the discharge of the *ascospores* about every ten days, regardless of the amount of rain. Some rain, even if it was only half a point, which occurred as dew, was recorded on every day except two during the whole three months. There was no dry period in which to determine whether the lack of rain would check the discharge of *ascospores*. (See Graph IV.)

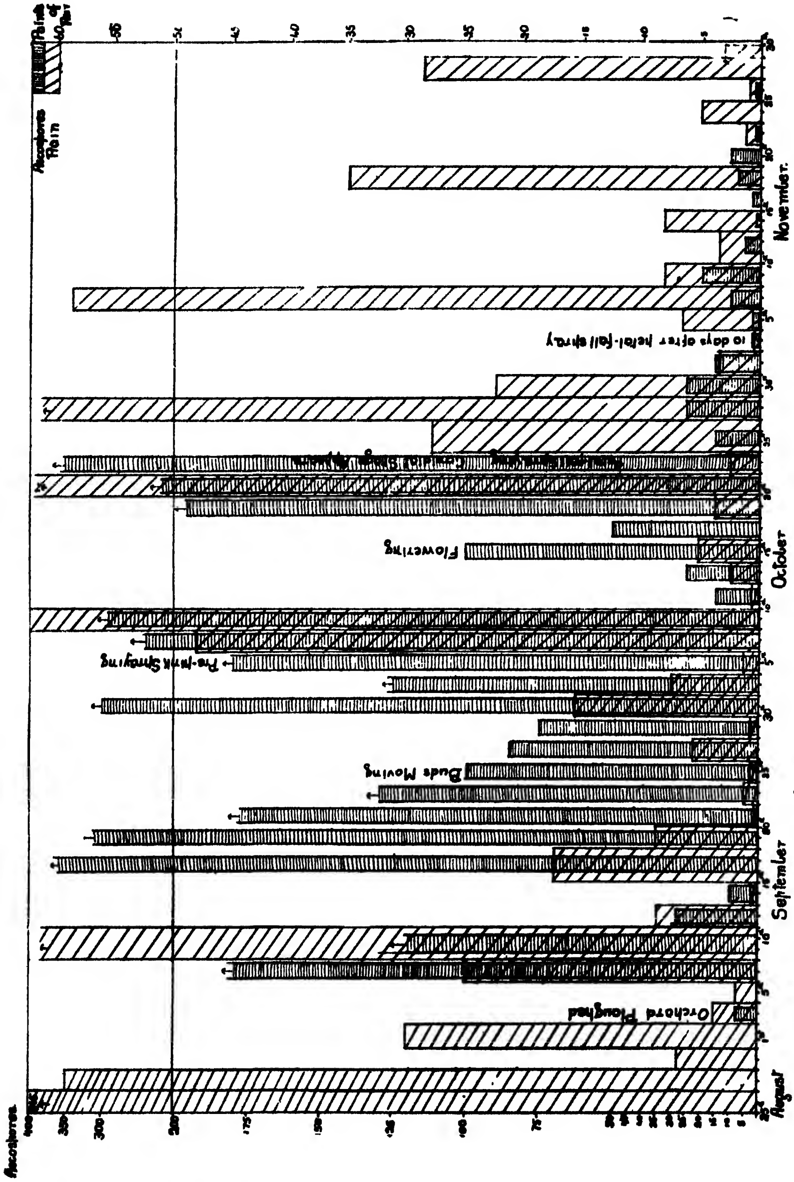
LIFE HISTORY OF VENTURIA PIRINA (ADERHOLD) AS OBSERVED IN WESTERN AUSTRALIA.

The *Fusicladium* or summer stage of the fungus occurs on the leaves, fruit, and young wood of the pear tree. It occurs as velvety black patches on each of these parts. The *mycelium* at this stage is very fine, colourless, branching, and sparsely septate. It lies between the epidermis and the cuticle, and masses of *mycelium* are often associated with stomates. This *mycelium* gives rise to *conidiophores*, which grow up through the cuticle, and bear *conidiospores*. These *conidiophores* are short, twisted and gnarled. The spores are budded off from these gnarled parts sympodially. (See Fig. 6.) The *conidiospores* known as *Fusicladium pirinum* (Aderhold) are boat-shaped, and dark brownish-green in colour. The average size of these spores is 18 x 7.4μ and they range between 23 x 8.2μ and 11 x 6 μ

After the leaves have fallen from the trees, about the end of May in W.A., the *mycelium* penetrates the dead tissue of the leaf, becomes stouter, more septa appear, and it begins to knot up and form the beginnings of *perithecia*. (See Fig. 5). In June the immature *perithecia* were easily recognisable, and had an average diameter of about 45μ. *Perithecia* of this size were plentiful, as many as three per square millimetre of leaf surface, having been found.

TABLE OF PERITHECIAL DEVELOPMENT.

Variety.	Date.	Average No. per sq. mm.	Average Diameter.	Range.
Beurre Bosc	June, 1932	2·4	44·5μ.	21·9μ.—146μ.
Glou Morceaux	June, 1932	2·25	36·7μ.	14·6μ.—65μ.
Beurre Bosc	July, 1932	3·5	50μ.	21·9μ.—80μ.
Glou Morceaux	July, 1932	4·5	62·8μ.	14·6μ.—189μ.
Beurre Bosc	Aug., 1932	5·5	70μ.	29μ.—122μ.
Glou Morceaux	Aug., 1932	...	...	...
Beurre Bosc	Sept., 1932	3·7	90·9μ.	30μ.—137μ.
Glou Morceaux	Sept., 1932	5·3	89μ.	30μ.—153μ.
Beurre Bosc	Nov., 1932	4·3	99·9μ.	45μ.—168μ.
Glou Morceaux	Nov., 1932	3	85·6μ.	45μ.—137μ.
Beurre Bosc	Feb., 1933	5	106·5μ.	45μ.—183μ.
Glou Morceaux	Feb., 1933	4·4	102μ.	61·8μ.—168μ.



Graph IV.

A Graph of the Average *Ascospore* discharge from six Beurre Bosc leaves and the Rainfall at "Merryup," Mt. Barker, during August, September, October and November, 1932. When more than five hundred *ascospores* occurred, five hundred were used in the calculation, the exact number of spores in excess of this number no being recorded.

None of these *perithecia* were mature till the beginning of September. The first discharge of *ascospores* took place on September 4th.

The *perithecia* are flask-shaped, and have an *ostiole* which is apparent from the time the *perithecium* is quite small (about 60μ in diameter). At maturity this *ostiole* terminates a neck, which is beset with stiff bristles. This neck penetrates the cuticle of the leaf, and through it the *ascospores* are discharged. The *perithecia* contain *asci*, or sausage-shaped sacs, each of which contains eight *ascospores*. The *asci* are produced in great numbers within the *perithecium*, and when the spores have been discharged the *asci* cannot be found within the *perithecium*. *Asci* with half their spores discharged have been found within *perithecia*, which also contained

asci which had not started to discharge. The average size of an undischarged *ascus* is about 48 μ.

The *ascospores* are olive-green in colour, unequally two-celled, the smaller cell being about one-third the length of the spore. The widest part of the spore is also

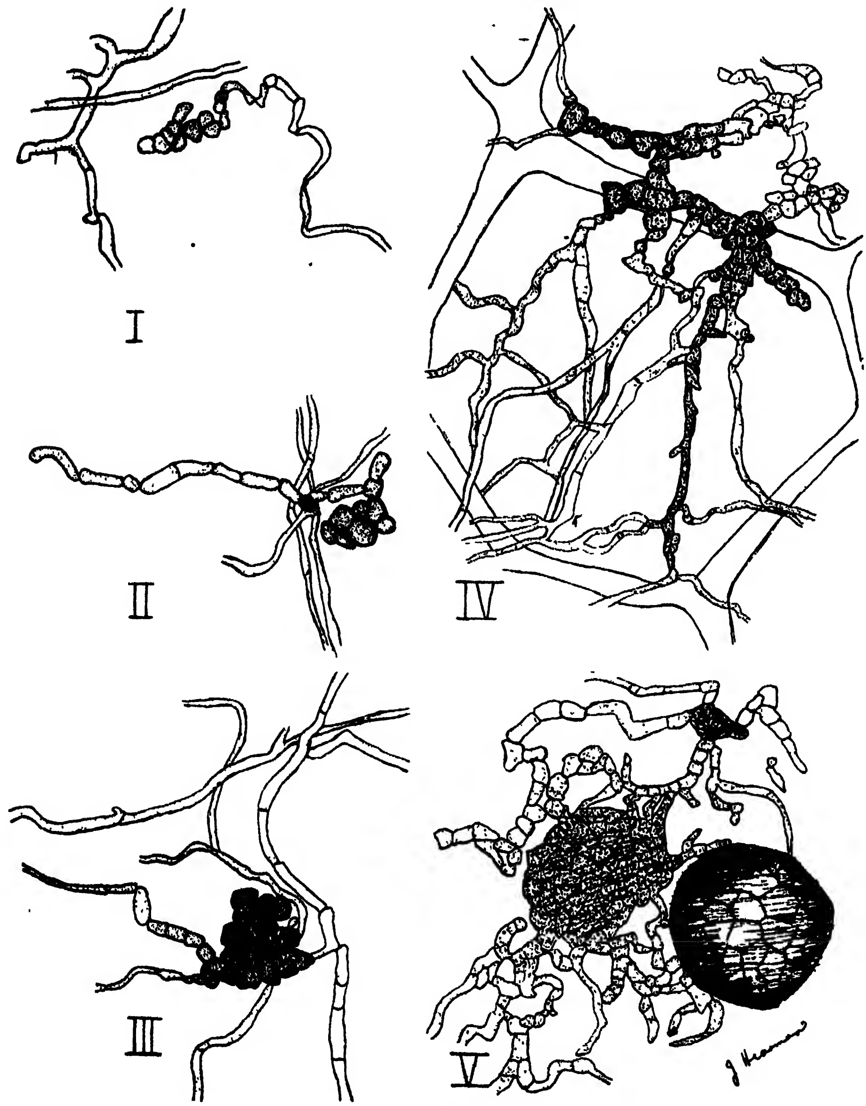


Fig. 5.

Mycelium of *Venturia pirina* in Beurre Bosc pear leaves. These leaves have been prepared by boiling in caustic soda (see text). Mag. × 410.

I., II., III., & IV. Early stages in perithecial formation in June.

V. Further stages in perithecial formation in July. (*Camera lucida drawings.*)

about one-third of the total length. The largest cell is always uppermost in the *ascus*. The average size of an *ascospore* is 12 x 4 μ.

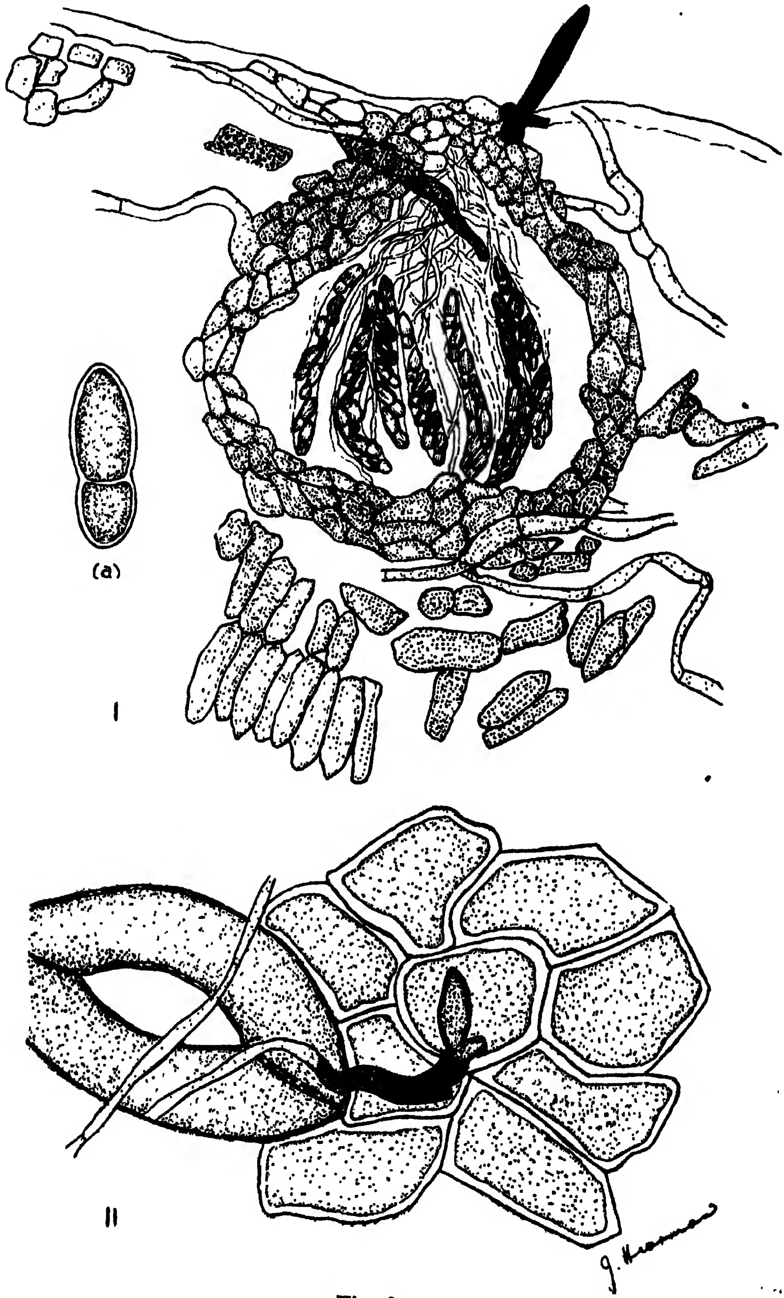


Fig. 6.

I. T.S. of an almost mature *perithecium* of *Venturia pirina* containing *asci* with *ascospores*. Note bristles at apex of *perithecium*. Mag. × 385.

(a) *Ascospore*. Mag. × 2080.

II. Portion of stripped *epidermis* of Beurre Bosc leaf showing strands of *mycelium* and a *conidiophore* budding off a *conidiospore*. Note stomate or breathing pore. Mag. × 770. (*Camera lucida drawings*.)

It has been observed from serial sections of *perithecia* at all stages of maturity that structures which are probably *paraphyses* are present in the immature *perithecia*. They are longer and more slender than the young *asci*, which stain more deeply with haematoxylin. At first they seem to occupy most of the young *perithecium*, but as the *asci* develop they become less and less evident, till in the mature *perithecium* they have practically disappeared. Accounts of *Venturia pirina* do not usually mention *paraphyses*. In descriptions of the genus *Venturia* Stevens (Stevens 1925) says *paraphyses* usually absent, while Lindau (Lindau 1897) refers to them as vanishing.

In November, when the discharge of *ascospores* had practically ceased, spores would appear on the slides, in groups, as if they had all come from one *perithecium*. The discharge would commence with quite a small number of spores, say twenty. In the next forty-eight hours the discharge, presumably from this *perithecium*, might be as much as seven hundred spores, and in the following forty-eight hours there might be only forty spores discharged, and then no more spores would be found on this portion of the slide. Thus the discharge from a single *perithecium* apparently occupied five to six days.

SUMMARY OF CONCLUSIONS.

The following are the conclusions drawn from the above investigation, but they cannot, without further confirmation, be held to be of general application in this State, although this is probably the case:—

Fungal Infection.

i. *Ascospores* were the chief source of primary infection in the spring.

ii. Wood lesions did not appear to carry the fungus over from season to season in these experiments.

iii. *Ascospores* were first discharged on 4th September, *i.e.*, nearly one month before the "green-tip" stage was reached by the pear trees.

iv. They continued to be discharged from the leaves left on the surface of the ground during the spring for three months.

v. More *ascospores* were discharged from leaves sprayed during the previous autumn than from those which were not.

vi. Leaves buried at the beginning of September had discharged all their *ascospores* after remaining buried for two months.

vii. No close correlation could be demonstrated between *ascospore* discharge and weather conditions at Mt. Barker, which were humid during the whole period over which the observations were made.

viii. *Conidiospores* did not spread the disease from tree to tree to any great extent.

Control of the Disease.

i. The disease was effectively controlled on a property where it had been unusually serious for some years prior to these experiments.

ii. Ploughing in of over-wintered leaves early in the spring, *i.e.*, before the buds burst, was an important factor in the control of the disease.

iii. Bordeaux Mixture was more effective on both varieties used in these experiments, *i.e.*, Glou Morceaux and Beurre Bosc, as a spray to control "Black Spot" of pears than Lime Sulphur, because it retained its protective qualities over a much longer period than did the Lime Sulphur.

iv. Four sprayings with Bordeaux Mixture, applied at the "green-tip" (5-4-50), "pre-pink" to "pink," "petal-fall," and "10 days later" stages (all 3-4-50), gave very good control of "Black Spot." (79 per cent. perfect Glou Morceaux fruit; 89.5 per cent. marketable.)

v. A spraying with Bordeaux Mixture (3-4-50) applied one month later improved the control. (89 per cent. perfect Glou Morceaux fruit; 93 per cent. marketable.)

vi. One spraying with Bordeaux Mixture in the early "pre-pink" stage had some effect in controlling the disease, even when the ground was not ploughed early.

vii. An autumn spraying did not appear to contribute to the control of the disease in these experiments, in which the trees were heavily infected at the time of the application.

viii. The cost of material for four applications of Bordeaux Mixture was 3.56 pence per tree.

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LIVE STOCK AND MEAT.

For the information of readers of this "Journal," the following particulars have been supplied by Messrs. Elder, Smith and Coy., Ltd., Perth:—

COMPARATIVE NUMBERS OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS FOR MONTHS OF MARCH, APRIL, AND MAY, 1933.

—	MARCH					APRIL.				MAY.				
	1.	8.	15.	22.	29.	5.	12.	19.	26	3.	10.	17.	24.	31.
Sheep...	13,440	12,048	11,240	10,583	11,200	10,568	8,500	11,330	8,422	8,740	10,441	11,620	11,151	9 992
Cattle...	902	586	517	575	521	583	423	460	*657	565	519	453	480	440
Pigs ...	1,185	1,066	1,347	1,477	1,570	1,744	1,263	1,804	2,194	1,904	1,673	1,179	1,429	1,319

* 140 Stores.

COMPARATIVE VALUES PER POUND.

Mutton	3¾d.	3½d.	3½d.	3½d.	3d.	3d.	3¼d.	3d	3d	3¾d.	3¾d.	4¼d.	4¼d.	4½d.
Beef ...	6d.	5¾d	6d.	5¾d.	5¾d.	5¾d.	5½d.	5½d.	5½d.	5¼d.	5d.	5d.	5d.	5½d.
Pork ...	5d.	4¾d.	4¾d.	4¾d.	5d.	5d.	5½d.	5¼d.	4½d.	4½d.	4½d.	5d.	5d.	6d.
Bacon...	4d.	4d.	4d.	3¾d.	3¾d.	3¾d.	3¾d.	3¾d.	3¼d.	3¼d.	3¼d.	3¼d.	3¾d.	4d.

MARKET REPORT.

Messrs. H. J. Wigmore & Company, Limited, of Wellington Street, Perth, have supplied us with the following information regarding the chaff available for auction at the Perth Railway Yards for the period March to May, inclusive:—

March.—1,215 tons of chaff, f.a.q., to prime was making from £4 12s. 6d. to £4 15s.; f.a.q., from £4 7s. 6d. to £4 10s. per ton. Medium quality was selling at from £4 to £4 5s. Prime oaten chaff was finding buyers at from £4 to £4 5s., f.a.q., at around £3 17s. 6d. per ton.

Oats.—Fair supplies were arriving for auction to a good demand. Good heavy feeds were realising from 1s. 10d. to 1s. 11½d.; good feeds from 1s. 8d. to 1s. 9d. per bushel.

Wheat.—F.a.q. was selling at from 2s. 9d. to 2s. 10½d., second grade from 2s. 6d. to 2s. 8½d. per bushel.

April.—825 tons of chaff. F.a.q. to prime wheaten chaff was finding buyers at from £4 15s. to £4 17s. 6d.; f.a.q. at from £4 7s. 6d. to £4 12s. 6d. per ton. Mediums were realising from £4 to £4 5s. per ton. Prime oaten chaff was selling at £4 7s. 6d. to £4 10s.; f.a.q. from £3 17s. 6d. to £4 per ton.

Oats.—Good heavy feeds were changing hands at from 1s. 9d. to 1s. 10d.; good feeds from 1s. 7d. to 1s. 8d. per bushel.

Wheat.—F.a.q. was finding buyers at from 2s. 10½d. to 2s. 11½d.; second grade from 2s. 7d. to 2s. 9d. per bushel.

May.—550 tons of chaff. Owing to the short supplies available the market firmed slightly. F.a.q. to prime was selling at from £4 15s. to £5; f.a.q. at from £4 10s. to £4 12s. 6d.; medium quality was making from £4 5s. to £4 7s. 6d. per ton.

Oats.—Very few consignments were arriving for auction, and good heavy feeds sold at from 2s. to 2s. 3d.; good feeds from 1s. 9d. to 1s. 11d. per bushel.

Wheat.—F.a.q. was changing hands at from 3s. 2d. to 3s. 4½d.; second grade from 2s. 9d. to 3s. per bushel.

H. J. Wigmore & Company, Limited, hold auction sales in the Perth Railway Yards each morning for chaff, grain, and potatoes, and all consignments forwarded to their care receive their best and prompt attention. The highest market prices with prompt returns are guaranteed.

PRODUCERS' MARKETS CO-OPERATIVE, LTD.

REPORT OF SALES FOR THE QUARTER ENDED 31st MAY, 1933.

Fruit.—The Bartlett pear crop was exceptionally heavy this season and, with very little export of this variety, values were low both for lines direct from the orchard and also for fruit *ex* cool store.

Late Valencia oranges were being marketed at the commencement of this period under review, realising bigger values.

The opening values of the new season navels were firm, but with supplies coming freely from all districts towards the end of the period and weather conditions being unfavourable, the demand eased considerably.

Apples of good quality have been short, and, with the exception of a few sales when the market was over-supplied with inferior and reject fruit for export, a good demand was experienced, particularly well-coloured dessert fruit.

Tomatoes, notwithstanding the lateness of the season, were heavily supplied, and it was not until the end of the period that supplies eased and the market reached a higher tone.

Grapes were *heavily* supplied, the quality being good and the demand steady throughout.

A light crop of passion fruit had the effect of a shortage of this fruit to a keen demand.

Eggs.—Although supplies from the country districts decreased considerably during March, all metropolitan lines were heavily supplied and sold at values ranging from 8½d. to 1s. 1d. a dozen for standard hen, 8d. to 10½d. a dozen for hen, and 6½d. to 9d. a dozen for pullet eggs. The market had not recovered from the slump prices recorded towards the middle and end of February, caused by a sudden rise in values and increased production, as reported in our review for the quarter ending the 28th February.

Market values remained in the vicinity of those mentioned above until the 24th March, when supplies from the metropolitan as well as from the country districts showed a considerable decrease in quantities, and values advanced on all lines

approximately 3d. per dozen. Apparently the advent of cooler conditions affected egg production and increased egg consumption, with the result that on the 29th March values advanced a further 5d. a dozen, bringing values up to 1s. 6½d. to 1s. 7d. for standard hen, to 1s. 6½d. and 1s. 7d. for hen eggs, and to 1s. 5d. to 1s. 6½d. for pullet eggs, and all lines sold to good clearances at these prices for a little over a week. In the first week of April supplies again showed a slight decrease, and values advanced a further 2d. a dozen for standard and hen eggs, but the demand for pullet eggs eased and values could not be maintained. Country eggs were short supplied, and sold to a good demand at values approximately 4d. a dozen below those ruling for metropolitan lines.

With high prices ruling, buyers who had cool store egg contracts commenced drawing on their cool store quantities; consequently competition for the new-laid egg eased, and, in spite of it being Easter time, values receded. On the Wednesday following Easter the demand was weak and values receded to 1s. 5d., 1s. 4d., and 1s. 2d. for standard, hen and pullet eggs respectively. Towards the end of April and the first fortnight of May supplies were much lighter, the demand was keen, and values advanced.

Owing to the mild winter the egg production was better than had been anticipated, but the demand was equal to the supply and values remained firm at prices ranging from 1s. 8½d. to 1s. 10½d. a dozen for standard eggs, 1s. 6½d. to 1s. 10d. a dozen for hen eggs, and 1s. 4½d. to 1s. 7½d. a dozen for pullet eggs. Towards the middle of May the cool store eggs were being freely drawn upon *ex* the ice works, and storekeepers reported that the sale of the cool store egg had seriously affected the sale of the new-laid egg and that sales were slow at the prices ruling. As a result the demand eased, and values receded approximately 1d. per dozen on all lines.

Towards the end of May heavy rains and strong winds affected the fowls, and caused egg production to decrease and values to reach their highest level for the season. Standard, hen, and pullet eggs sold to a very keen demand with values firm at 1s. 11½d. to 2s. a dozen, 1s. 11d. to 2s. a dozen, and 1s. 11d. to 1s. 11½d. a dozen respectively.

Poultry.—Poultry during March was heavily supplied, with good inquiries for prime quality, which sold to a good demand. The quality throughout, with the exception of a few pens of cockerels and hens on each sale day, was not up to the requirements of the trade, and as a consequence did not realise the best values. The cockerels were either too old, half-grown, and not in the best of condition. Good cockerels realised up to 9s. a pair and good hens up to 7s. 6d. a pair. Muscovy ducks and drakes were slow of sale; prime birds realised fair values, but half-grown or aged birds were hard to quit at low values. Turkey hens and gobblers were in demand, but both the supplies and the quality did not come up to the requirements of hte trade. Good gobblers and hens realised up to 25s. a pair and 13s. a pair respectively.

In the first fortnight of April supplies were maintained, with values unaltered. Towards Easter supplies increased and sold to a good demand for prime quality; medium and light quality realised accordingly. On the Wednesday prior to Easter supplies were exceptionally heavy, and it is considered to have been the heaviest supply of all lines on any particular sale day, either at Easter or Christmas. The supplies were much heavier than the demand and values were affected. Prime quality realised moderate values, but medium and poor quality were hard to quit at low values.

After Easter supplies were much lighter, and prices returned to normal values. Towards the end of April and during May supplies were moderate, with prime cockerels scarce, and realising up to 8s. 6d. a pair. Staggy cockerels were heavily supplied, but were too old for trade requirements. Prime hens sold to 7s. 6d. a pair; Muscovy ducks and drakes were still slow of sale, although some prime drakes realised up to 11s. 6d. a pair. Prime gobblers and turkey hens were scarce, with good inquiries for same. White leghorns decreased in supplies and sold at improved values.

Vegetables.—Potatoes early in the period were feeling the effect of the low values obtained in previous weeks, but when stocks of metropolitan lines were becoming exhausted, values lifted considerably. Some new dug were also offered, and these had a brightening effect on the market also. Country lines were in better demand and values were on a payable basis. These values were maintained, and at present all lines are in good demand, values gradually firming for all prime lines. Second grade lines have also found a fair market. Prime sweet potatoes found a steady market for fair quality lines.

Pumpkin of right size and quality found a ready market during the quarter, but far too much inferior quality was marketed. These lines were hard to quit at satisfactory prices.

Swedes were short supplied, and a steady demand existed during the period. Cabbage values were at their peak during March and April, and usually during May values suffer a relapse, but owing to the late season values were well maintained. Growers experienced a good season.

Peas maintained a steady level throughout at satisfactory values.

Beans were scarce during March and early April, and high prices were recorded. New crops coming in during the latter part of April and early May caused values to ease, but were again good during the last half of May.

Cucumbers were plentiful and all prime lines in steady demand.

Marrows also maintained a steady value.

Rhubarb was heavily supplied during the whole period, but the bulk was of poor quality and values for all lines suffered in consequence.

Celery was always well supplied, and special lines were always in good demand.

Lettuce also was heavily supplied, and, while prime samples sold well, inferior grades were hard to quit.

White and brown onions early in the quarter were plentiful and values were low. During the latter part of the period, however, values firmed somewhat.

Cauliflowers were at their glut during the period, but supplies were not so plentiful this year as in other years, and values have been better in consequence. Bunch lines were heavily supplied for all sales, and values for beetroot and turnips at glut level. Parsnips and carrots maintained a steady level at satisfactory prices.

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.		
	MARCH, 1933.				inches.	inches.
Chapman State Farm	90·0	108·0	66·2	52·3	93	1 63
Geraldton	83·8	103·2	66·3	55·0	74	1 47
Walebing	87·8	108·2	61 1	48 2	·17	1·78
Perth	81·3	100·5	61·7	49 6	1·15	·76
Kalamunda	81·4	100·0	59·9	46·5	·98	·81
Bunbury	77 7	92·0	56·1	40·3	37	·99
Bridgetown	82·0	97 0	51·2	36·8	1·08	1·04
Albany	71·8	91 6	57·6	48·0	1·94	1·53
Merredin State Farm	85·8	98·5	59·3	42·0	·14	1·05
Northam	86·3	105·4	66·0	48·1	·97	·72
York	84·7	103·0	58·7	47·0	1 25	63
Narrogin State Farm	81·1	92·5	51·7	38·8	50	[illegible]
Katanning	80·0	92·1	54·7	44·7	·95	·95
Cape Leeuwin ...	73·2	94·8	61·5	52·0	·85	1·20

Stations.	Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.		
	APRIL, 1933.				inches.	inches.
Chapman State Farm	86 0	97·8	56·1	43·5	·57	·48
Geraldton	83 5	95 5	60 9	51·8	·12	82
Walebing	82·2	95·0	54·0	44·0	·41	·81
Perth	78·6	89·8	58 1	48·2	·80	1·70
Kalamunda	77·5	87·1	58·5	49·1	1·15	2·05
Bunbury	75·4	84·0	50·3	40·0	1·82	1·71
Bridgetown	77·3	88·5	47·3	34 8	1·39	1·72
Albany	69 8	84·8	54 1	40·6	4·00	2·75
Merredin State Farm	79 7	95·7	52·1	40 2	·16	93
Northam	82·8	95·2	53 0	44·0	·25	·83
York	80·5	93·0	50·4	42 0	·45	·82
Narrogin State Farm	76 8	89·2	51·0	39 0	1 00	1·13
Katanning	75 7	90·0	50 6	40·3	·45	1·19
Cape Leeuwin ...	73 7	86·2	60·4	50 0	2·50	2 26

Stations.	Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.		
	MAY, 1933.				inches.	inches.
Chapman State Farm	73·8	88·7	52·4	43·8	3·91	2·47
Geraldton	73·9	86·8	57·6	51 0	2·56	2 81
Walebing	69 3	86·0	49·4	41 0	3·31	2·63
Perth	69·2	87·1	52·7	44 9	4·67	5·12
Kalamunda	66·1	85·0	52 5	43 0	5 32	6·29
Bunbury	67·9	80 3	49·6	41·0	4·19	5·21
Bridgetown	66 8	85·0	44·5	32·0	3·20	4·66
Albany	65 6	82·6	51·2	41·0	5·93	5·01
Merredin State Farm	68 1	82·8	46·4	32·0	1·60	1·61
Northam	70·3	96·8	47·8	38·5	5·22	2·25
York	69·0	85·0	45·9	37·0	3·91	2·35
Narrogin State Farm	65·5	82·5	46·8	37·6	4·33	2 61
Katanning	64·8	82 0	46·7	36·0	2·38	2·42
Cape Leeuwin ...	68·3	82·5	57·6	47·0	4·58	5·86

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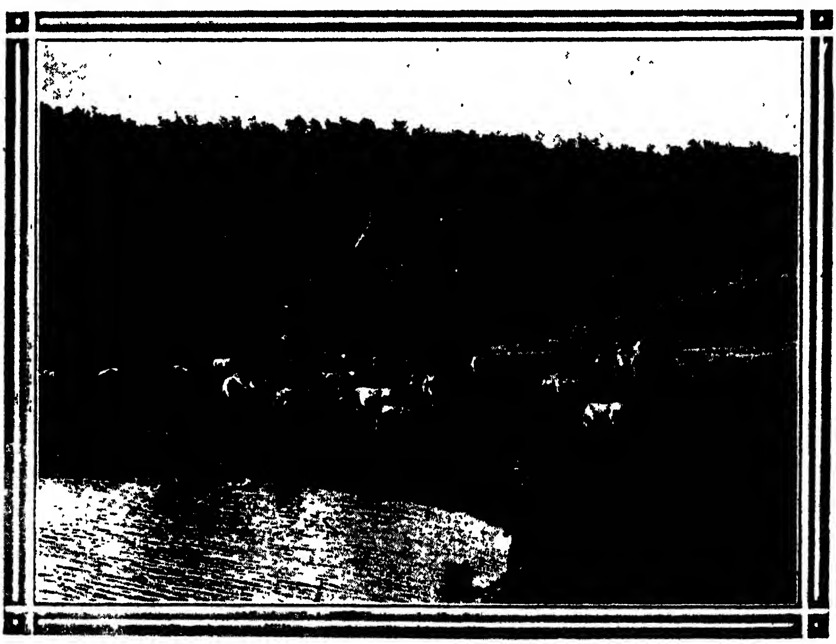

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SILAGE MAKING BY THE HOT AND COLD PROCESSES.

An extract from the Inaugural Thesis, entitled "The Historical Development of the Conservation of Green Fodder by Ensilage," prepared by Dr. H. Krause, Dr.Phil.Nat., as part of the requirements for the Degree of Doctor in the Faculty of Higher Mathematics in Natural Science at the State University of Thuringia at Yena.

Prepared from the Author's Translation by GEO. L. SUTTON,
Director of Agriculture.

Green fodder crops can be conserved in two ways—by drying and by making them into silage. The oldest and commonest method of conservation of green fodder is by drying in the air, as is customary in the ordinary process of hay-making. In this way the water content of the green material is reduced from 70 to 80 per cent. down to 10 to 13 per cent. This method is the simplest and most natural way of conserving green fodder. If it were possible to utilise this excellent method of conservation during any part of the growing period, and under all climatic conditions, without great losses in food value, then this natural system of air drying would be unquestionably the best. In the temperate zone, however, the losses in food value, as the result of making hay, are high, even during good weather and with plants which dry quickly.

Experiments to study the losses which occur during the process of air drying have been carried out by Professor Wiegner, of Zurich. According to these experiments the losses under favourable weather conditions amount to 40 per cent. of the starch equivalent, and range from 14 to 40 per cent. of crude protein.

The most efficient system of conserving green fodder is by artificial drying. The result is a product which will keep indefinitely and sells readily. Legumes artificially dried, for instance, are found to be valuable concentrate, rich in protein. The disadvantages of artificial drying are the high costs involved, as to dry grass containing 1 cwt. of starch equivalent (11 cwt. grass) 2 cwt. of coke were found to be necessary.

Later experiments dealing with the presence of vitamins show that a number of vitamins are partly or completely lost during the process of hay-making. Thus in this direction also the food value of the hay is considerably less than the food value of the original green fodder.

Another section of these experiments showed that the loss of vitamins is very much less when the same green fodder is made into silage, and also that the modern method of making good silage is associated with comparatively small losses of the starch equivalent, or the energy value of the food.

It will thus be seen that the transformation of green fodder into silage, when properly carried out, is to be preferred to hay-making because of the relatively small loss of food value, including the very small losses of vitamins which occur when the crops are conserved as silage.

The many methods followed by farmers in making silage can be grouped under two different systems, namely, what are known as—

(a) the cold fermentation system, and

(b) the warm fermentation system.

Under the system of **cold** fermentation the freshly cut green fodder is placed in the pit or silo, and is packed by tramping as quickly and as firmly as possible, so as to drive out, without delay, the maximum quantity of air from between the stems and leaves. The oxygen of the small quantity of air which then remains is absorbed by the plants themselves by respiration (breathing) and without any great rise in the temperature of the mass. Usually the rise in temperature does not exceed 10° Fah. After a short period of intra-molecular respiration the plants die by suffocation: during this period small quantities of organic acid are developed by incomplete oxidisation. After this, as the result of the development of certain lactic acid bacteria, especially *Bacterium cucumeri fermentati* and *Bacterium lactis acidi*, a part of the soluble carbohydrates is transformed chiefly into lactic and other organic acids. When the concentration of acid reaches about two per cent. of the total volume of the silage, fermentation stops and the green fodder is then preserved as the result of the acid formed.

When it is intended to use the **warm** fermentation process of making silage, it is necessary that the green crop be allowed to wilt after cutting, until the water contents are reduced to between 65 and 70 per cent. The silo or pit is then filled slowly, and without packing, at the rate of from three to six feet each 24 hours. Under such conditions there is an abundance of air amongst the greenstuff, and this is used by the plants for intensive respiration, and, in consequence, the result is a great rise in temperature. When the temperature rises to over 120° Fah. the mass of silage is firmly packed by tramping, or by the application of pressure by other means.

The high temperature of the silage resulting from rapid respiration of the plants, and the work of the thermophilic (heat loving) bacteria causes the death, by heat, of the green plants and of many heat sensitive micro-organisms. Those which are killed do not, however. include the so-called warm lactic acid bacteria. *e.g.*, *Bacterium kolbrucki*, *Bacterium bulgaris*, and certain *Streptococcus spp.* The optimum temperatures at which these bacteria flourish lie between 105° and 120° Fah., and they are able to live in the absence of air, that is, they are anaerobic. The pressure applied to the material in the silo drives out the air, and this condition, combined with the temperature prevailing (not exceeding 120° Fah.) provides favourable conditions for the warm lactic acid bacteria to develop.

As the result of the pressure being applied the air is driven out, the temperature ceases to rise and slowly declines. The slow fall in temperature is important, for it is very desirable that, as the result of the activities of the warm lactic acid bacteria, the acid contents of the silage mass should have reached from one to one and a-half per cent. by the time the temperature falls to 105° Fah. This degree of

acidity stops the fermentation and the silage is conserved. Unless acid is developed to this extent before the temperature falls below 105° Fah., the butyric acid bacteria become active under the anaerobic (without air) conditions and produce a foul-smelling silage, with the odour of rancid butter and of decreased feeding value. The butyric acid bacteria flourish at temperatures ranging between 95° to 105° Fah., and can even form spores at higher temperatures.

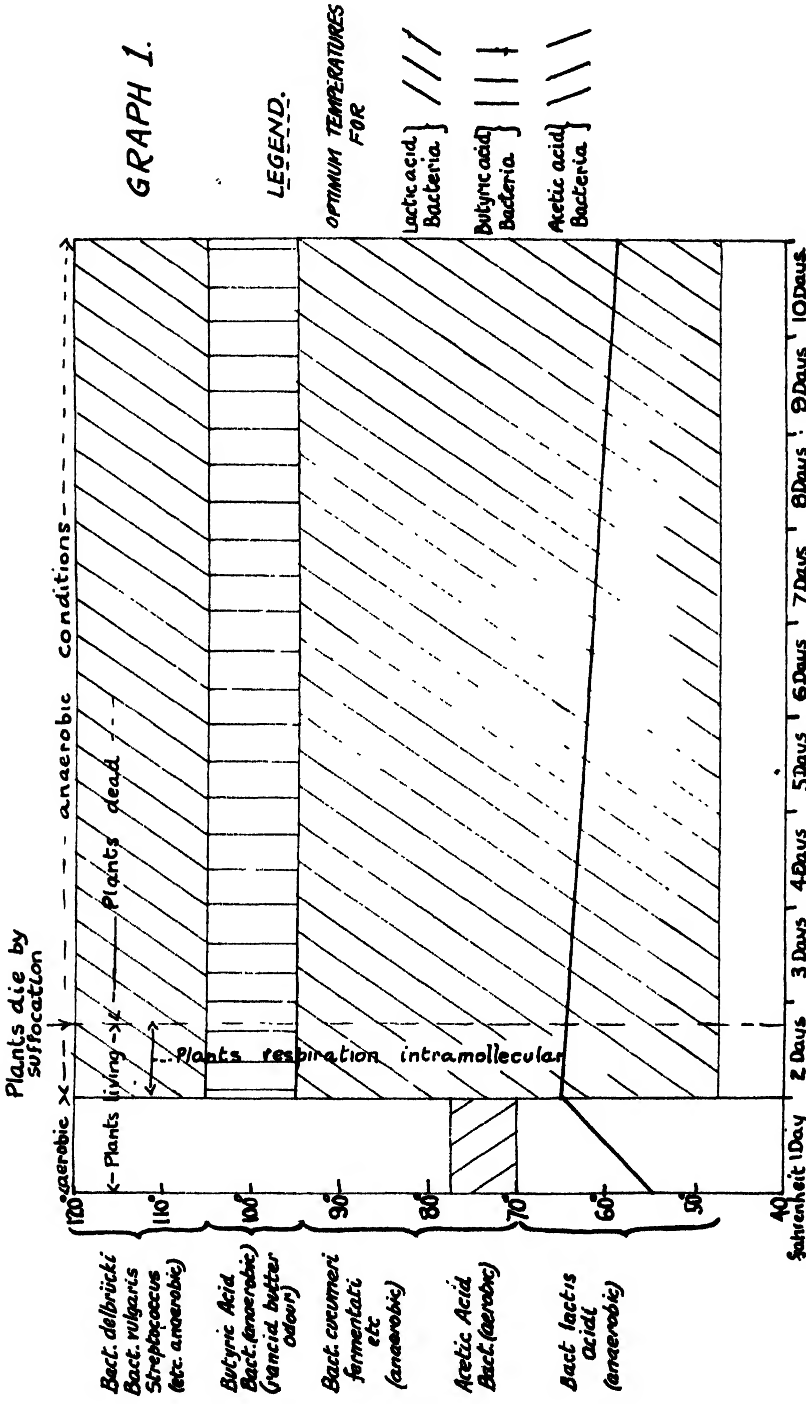
By the adoption of the cold fermentation method it is easy, provided it is properly done, to keep the temperature *under* the optimum temperature for the growth of the butyric acid bacteria. The risk of forming butyric acid in the silage is, therefore, very much greater when the warm fermentation method is used than when the cold one is adopted. Under the warm fermentation method the only chance of preventing the formation of butyric acid is for the temperature to be kept between 105° and 120° Fah. for sufficiently long to allow for the development of about one and a-half per cent. of lactic acid, and to stop the fermentation. Obviously, to control the temperature until the proper degree of acidity is reachd is not easy, and very often will be impossible.

The undesirable development of acetic acid bacteria, which are aerobic, *i.e.*, need air for their development, is also very easily prevented by the adoption of the cold fermentation method with the exclusion of air. It is comparatively easy to create anaerobic (without air) conditions as the result of tramping the green material is firmly as possible immediately it is placed in the silo or pit; this thorough packing drives out the air in the mass of green material and excludes the entry of fresh supplies.

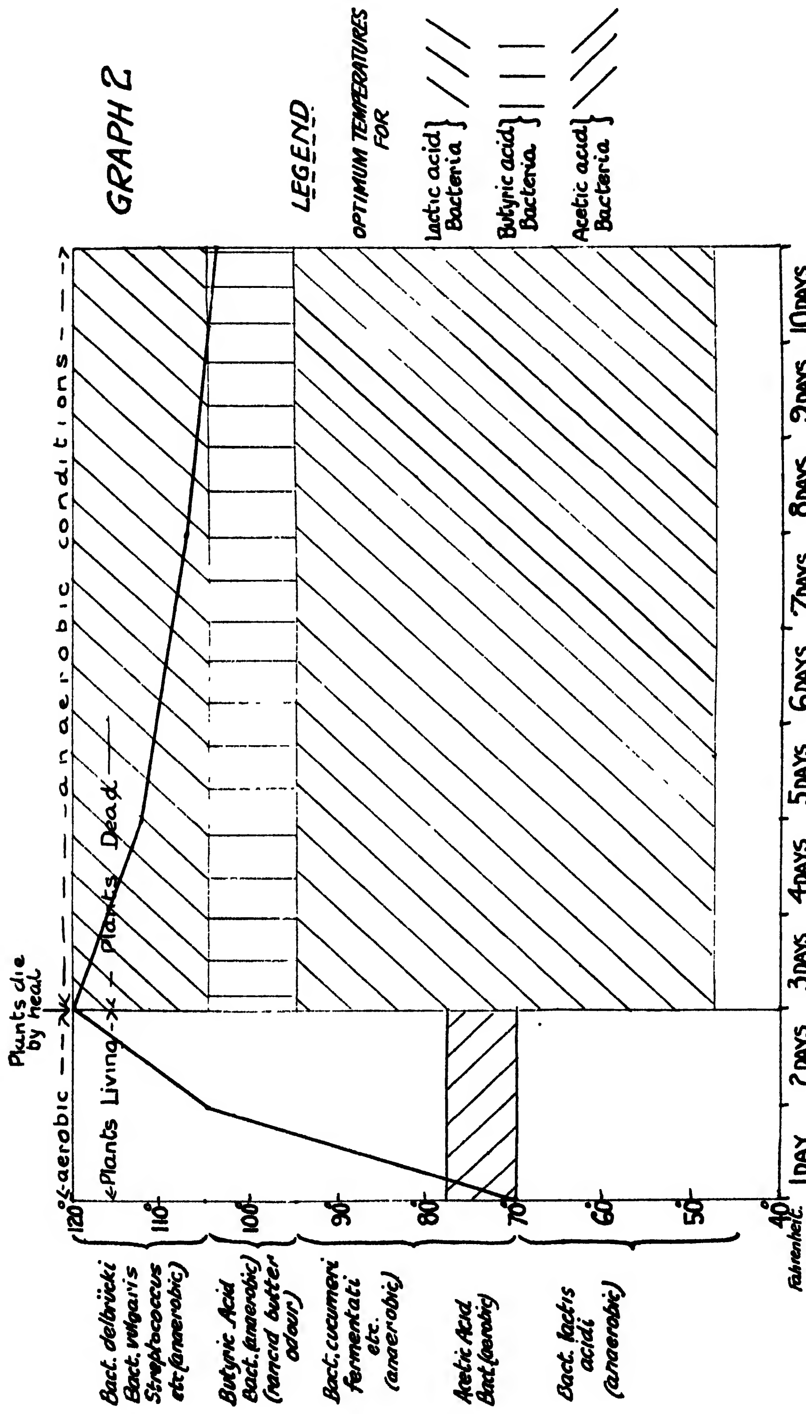
The two graphs herewith illustrate the changes that take place under the two methods. On the horizontal line the number of days (one to nine) from the commencement of the process are shown. On the vertical line the temperatures reached are shown. The optimum temperatures of some of the types of bacteria referred to are also given; the optimum temperatures for the lactic acid bacteria are shown thus /////; those of the butyric acid bacteria thus |||||, and those of the acetic acid bacteria thus \\\\\.

Graph No. 1 shows the changes resulting from the cold fermentation method. The temperature of the crop on going into the silo was 55° Fah. As the result of the firm packing at the time and the respiration of the plants, a rise in the temperature was found to occur only during the first day. After the end of this day the temperature had risen to 65° Fah., that is, lower than the optimum temperature of the acetic acid bacteria, which is from 70° to 80° Fah. During the second day the remainder of the oxygen in the air was used up, and the establishment of anaerobic conditions were completed. This prevented the further formation of acetic acid for the bacteria responsible, for this cannot develop under anaerobic conditions. After a short period of intra-molecular respiration the plant cells died of suffocation. Following this the temperature fell very slowly, and remained for a period of at least eight days within the optimum temperature of the cold lactic acid bacteria. It will be noticed that the optimum temperature for the anaerobic butyric acid bacteria was not reached during the process and hence the unpleasant smell caused by these bacteria was not generated.

Graph No. 2 represents the results of the warm fermentation method. The temperature at which this material was taken to the silo was 70° Fah. This was as the result of the partial drying which the material received in the paddock after being cut and prior to being placed in the silo. Because of the loose packing at the outset the respiration of the plants was intense, and, as the result of this, the temperature rose quickly, reaching 120° Fah. by the second day, and the



The Cold Fermentation System.



The Warm Fermentation System.

plants were killed by the heat. The material in the silo was then packed and as much of the air forced out as possible; the conditions became largely anaerobic. Under these anaerobic conditions, and with a temperature between 105° and 120° Fah. the warm lactic acid bacteria developed and formed lactic acid. During this process the temperature decreased slowly, and on the ninth day reached, as shown on the graph, the optimum temperature of the butyric acid bacteria. As already pointed out, it is important that prior to this the lactic acid contents should have reached one to one and a-half per cent., otherwise the butyric acid bacteria would develop butyric acid and more or less decrease the value of the silage.

In practice the cold fermentation method provides a much better opportunity and a safer means of producing good silage. Some of the most important points which have to be watched carefully to get the best results with the cold fermentation method are:—

1. To have the right kind of green feed, *e.g.*, cereals or mixed pasture.
2. To cut it at the right age, *e.g.*, oats in the milky stage.
3. To cut it evenly and well with a silage cutter or chaff cutter, so that it will pack readily.
4. To pack it as quickly and as firmly as possible in silos or in pits so as to drive out and exclude the air.
5. To prevent further access of air to the material in the silo. To achieve this it is necessary, if earthen pits are used, to cover the silage quickly and make it air-proof, not only on the top, but also on the sides. As the silage in a pit silo packs itself more closely together it is also necessary, especially in the first weeks, to fill up the openings or cracks which appear in an earth covering on the top; this should be done every day if necessary.

Another important point which may be seen from an examination of Graph No. 1 is the maintenance of the silage at a cool temperature, so it is advisable, if possible, to build the silo or pit in a shady place. No rainwater must run into the silo or pit. Because of this, adequate cover must be provided, and, in the case of the pit-silo, drainage by means of a trench around the pit would often be useful.

CATCHING AND INTRODUCING

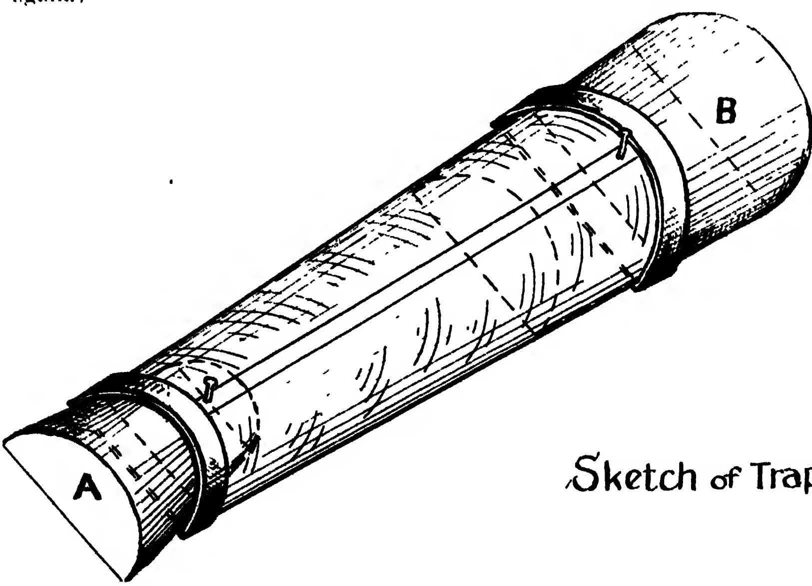
H. WILLOUGHBY LANCE,
Apiculturist.

The catching of a queen for placing in another hive or in a mailing cage is to beginners a difficult operation. Even with experienced beekeepers there is the possibility that the queen, being full of eggs, may be slightly injured and her egg-laying thereafter affected, even causing the bees to supersede her.

For this reason alone, apart from the likelihood of a queen that has been handled taking a strange odour into the hive, which may cause balling, I consider that a queen should not be handled more than is absolutely necessary, such as when it is desired to clip the queen's wings.

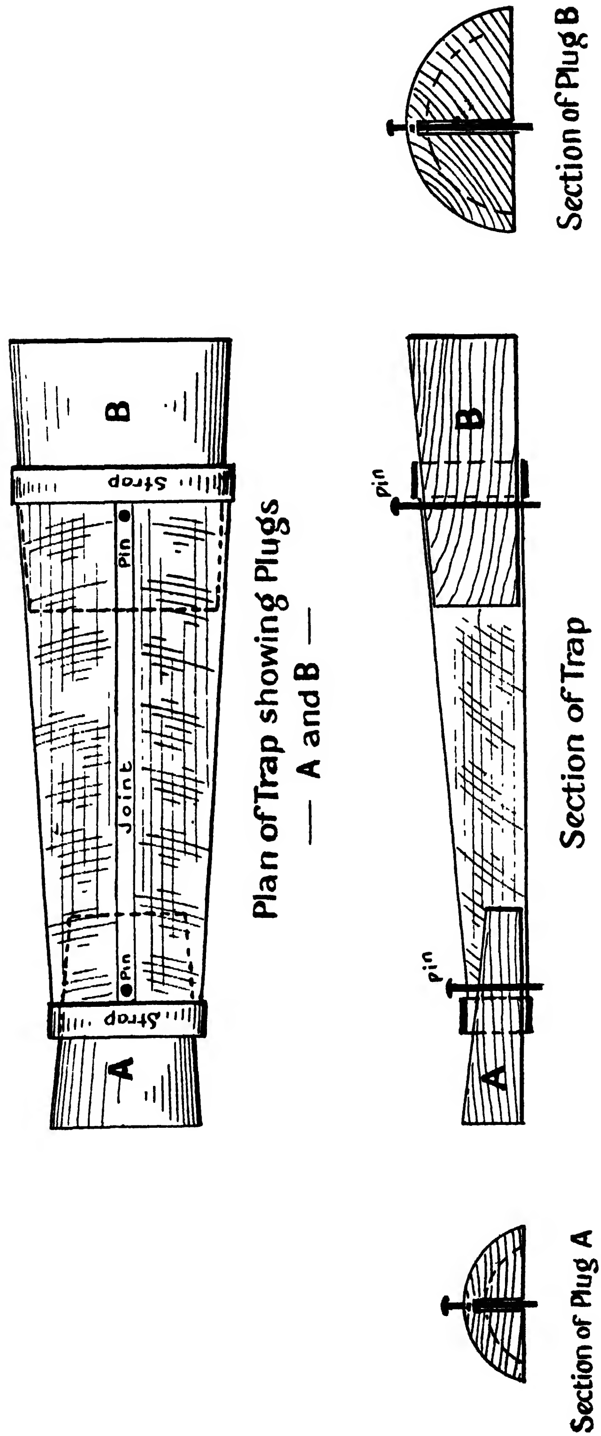
Queens reared by our Department are never handled from the time they are hatched to the time they are sent away from the apiary. To enable this to be done we use a queen catcher, which may be of interest to apiarists.

This is made of fine wire gauze, commonly called in Australia "fly wire," as shown in sketch. First, two strips of tin about ¼in. wide are cut for the end pieces, bent to shape and soldered; a strip of fly wire 4in. long is next cut and bent to shape, one end to fit the large tin end piece and the other the small end piece; this is then soldered down the join and to the end pieces. Plugs of wood are then cut to fit each end, pushed into place, holes drilled through the tin and wood to take a nail to prevent the plugs falling out. (Before I used these nails, I once lost a very fine queen which I had caught and was carrying in my pocket. When I took the cage out of my pocket the large plug was out, as also was the queen. The plug was still in my pocket but the queen was not, and hunt as I would I never found her again.)



Sketch of Trap

The catcher is used as follows: Take the large plug out and lay in a handy place by the hive. Find the comb with the queen on and lay on top of hive; take the cage in left hand and plug in right; place the cage in front of queen when


Plan of Trap showing Plugs
— A and B —
A
B
Strap
Strap
Pin
Pin
Joint
Section of Trap
pin
pin
Section of Plug B
Section of Plug A

walking; give the bees at back of queen a push with the plug to hurry the queen into the catcher; then put the large plug in and don't forget the nail. By this means several bees may be caught with the queen.

To get the queen out quickly the long plug must be used. When the queen is at the small end, remove the large plug and insert the long plug, carefully pushing this in so as not to catch any bees. This should go in to within about an inch of the small plug. When this is removed, the queen and bees will quickly go out at the small end.

With regard to the introducing of queens, there is one method which I have never seen referred to in any Bee Journal: whether it is used by many I do not know. It is what I call the "paper bag" method. I always use it, and only on one occasion did it fail, and this was my own fault. Take a small thin paper bag, such as is used for sweets. Place in this bag, by herself, the queen to be introduced. Remove the old queen from the hive. Catch half a dozen young bees that are filling up with honey at the cells and place them in the bag with the queen. Queen and bees are so anxious to get out that there is no trouble. Screw up the end of the bag and place between the frames. The queen will be released in a very short time and no queen cells will be built, and it will not be necessary to hunt for these later. The whole job has been done in one operation, but of course it is advisable to examine the hive four or five days later to ensure that the queen is "O.K." and laying, as there is the possibility but not the probability of something having gone wrong. Of course, when the old queen is caught, the combs should be examined to make sure there are no queen cells.

WESTERN AUSTRALIAN F.A.Q. WHEAT.

ANALYSES OF SAMPLES.

R. P. ROBERTS, B.Sc.Agri. (Hons.), Agricultural Adviser.

The mechanical and chemical analyses of the F.A.Q. standard for the five seasons 1928/29 to 1932/33 are given in the accompanying table. The chemical analyses were carried out by the Government Analyst's Department:—

	1928/29	1929/30	1930/31	1931/32	1932/33
	%	%	%	%	%
Moisture	11.94	10.41	12.00	8.98	10.51
Declared bushel weight	62½	62½	62½	61¾	62
Impurities and screenings	3.00	3.60	3.96	3.87	3.44
Total millable grain	97.00	96.40	96.04	96.13	96.56
Protein (N. × 5.7)	..	..	..	10.00	9.92
Ash	..	..	..	1.42	1.70
Products—					
Flour	71.3	71.5	70.7	71.0	71.0
Bran	19.2	19.9	19.7	19.3	19.6
Pollard	9.5	8.6	9.6	9.7	9.4
Flour—					
Water absorption	54.50	54.75	55.75	55.00	53.0
Protein (N. × 5.7)	8.70	9.52	10.14	10.80	8.78
Gluten—Wet	25.81	24.70	30.36	29.50	24.88
Dry	8.23	8.45	10.01	10.12	9.90
Hydrated maltose	..	..	..	..	1.49

HERD TESTING.

THE OFFICIAL AUSTRALIAN PURE-BRED DAIRY CATTLE PRODUCTION TESTING SCHEME, 1932–33.

The results for the following cows were not available in time for publication in the last Journal, and complete the list published therein :—

Name of Cow.	Breed	Herd Book No.	Date of Birth.	Date of Calving.	No. of Days in Test	Weight of Milk Last day of Test.	Weight of Milk for period.	Average Test	Butter Fat	Owner.	Sire.
MATURE COWS (OVER 5 YEARS OLD)—STANDARD 350 LBS. BUTTER FAT.											
						lb.	lb.	%	lb.		
Denmark Rose Dame	Guernsey	1794	19–8–27	24–8–32	273	27	10168	4·5	454·78	Denmark State Farm	Rose Chief of Wollongbar
Nancy 9th of Raleigh	A.I.S. ...	15719	30–4–29	12–8–32	273	16	8658	4·8	419·03	D. Bevan .. .	Union Jack of Raleigh
Blanche 4th of Minathorpe ..	do. .	15114	16–7–25	27–8–32	240	7	9255	4·4	396·51	R. Bee & Sons ...	Collier of Darbalara
Blanche 5th of Minathorpe ...	do. ...	17936	16–5–26	30–8–32	273	16	8778	4·3	375·16	R. Bee & Sons ..	do. do.
Topsy Rye of Grass Vale ...	Jersey ..	15702	1–7–23	8–9–32	240	12½	7035	5·3	370·58	C. H. Ironmonger ...	Rye Duke of Glen Iris
Banyule Velveteen 12th ...	do. ...	24474	11–9–27	17–9–32	273	17½	7022	5·2	367·59	Sabina Vale Stud ..	Wotton Airman
Wooroloo Gem	A.I.S. ...	15143	28–9–26	2–10–32	273	19	8157	4·5	364·95	Wooroloo Sanatorium Farm	Commercial of Black Heath
Banyule Silvermine 38	Jersey ..	18817	19–10–25	29–9–32	273	19½	6753	5·2	352·13	Sabina Vale Stud ...	Wotton Airman
Springmead Flower Girl ...	do. ...	13876	25–2–23	7–9–32	273	20	8400	4·1	344·47	Sabina Vale Stud ...	Springmead General
Grangelea Buttercup	do. ..	26388	21–3–27	5–9–32	273	17½	6517	5·0	337·82	Sabina Vale Stud ...	Grangelea Dairy's V.C.
Wollongbar Golden Pearl 5th ...	Guernsey	1128	8–9–24	21–9–32	273	13	5289	5·3	282·89	Muresk Agricultural College	Judge of Wollongbar
Brookvale Noble Lass	Jersey ...	20866	2–8–25	2–9–32	240	15½	5580	5·0	277·98	G. F Combs ...	Noble Lad of Roelands
Denmark Rosa	Guernsey	1429	15–12–25	9–8–32	273	14	5952	4·6	277·44	Denmark State Farm	Rose Chief of Wollongbar
Shiela 2nd of Sarnia	Jersey ...	20862	10–1–25	24–8–32	180	13½	3300	5·3	176·94	F. P. Atwell	Werribee's Starbrights Butterking
Girlie 4th of Sarnia	do. ...	17943	16–8–24	16–10–32	120	17½	2940	..	125·88	F. P. Atwell	do. do. do.
COW OVER 4½ YEARS AND UNDER 5 YEARS OLD—STANDARD 330 LBS. BUTTER FAT.											
Limelights Camellia of Wongara	A.I.S. ...	17879	24–7–27	19–4–32	273	28	10464	4·2	429·55	W. G. Burges ...	Limelight of Darbalara
COWS OVER 4 YEARS AND UNDER 4½ YEARS OLD—STANDARD 310 LBS. BUTTER FAT.											
Victress of Toora	A.I.S. ...	17867	7–3–28	9–8–32	273	28	10074	4·7	475·48	W. G Burges ...	Victor of Darbalara
Empress 4th of the Hill ...	do. ...	15703	26–5–28	20–9–32	273	27	10821	4·3	431·56	W. G. Burges ...	Crescent of the Hill
Glenoshee Ada	Jersey ...	28492	3–8–28	26–9–32	273	19	6657	4·8	318·74	Sabina Vale Stud ...	Burnside Moolton
Spangle 8th of the Hill ...	A.I.S. ...	15749	17–4–28	9–9–32	273	12½	7192	4·4	315·06	W. G. Burges ...	Crescent of the Hill
Karridale Lady Biddy ... —	Guernsey	2332	29–5–28	6–8–32	273	12½	5902	5·1	307·75	E. D. P. Hayes ...	Minnamurra Oliver Twist
Pendant of East View	A.I.S. ...	18339	18–6–28	1–8–32	210	19	6635	3·6	236·80	A. E. Grant	Sultan of East View
Woodendale Lassie	Jersey ...	...	14–6–28	10–9–32	150	12½	3195	...	138·90	F. P. Atwell	Mokine Lady's Chief

COWS OVER 3½ YEARS AND UNDER 4 YEARS OLD—STANDARD 290 Lbs. BUTTER FAT.

Juadine Peerless Lily 3rd ...	Jersey —	28183	29-9-28	27-9-32	273	19	7557	5·8	443·67	Miss L. Hancock ...	Larry of Duadine
Karawara Lofty 2nd	A.I.S. ...	15950	5-2-29	8-9-32	273	27	9411	4·1	390·11	W. G. Burges	Sailor of Karawara
Juadine Sparkle 3rd	Jersey ...	28185	15-9-28	14-9-32	273	15	7050	4·9	346·84	Miss L. Hancock ..	The Valley Twilish Fox
Tolyarup Della 2nd	A.I.S. ...	2503	11-11-28	23-7-32	273	11	8238	3·9	324·51	A. E. Grant	Baron of Darbalara
Karridale Royal Lady	Guernsey	2333	10-10-28	4-8-32	273	11	6168	5·3	319·96	E. D. P. Hayes ...	Minnamurra Oliver Twist
Claremont Biddy 9th	A.I.S. ...	...	18-8-28	5-8-32	273	16	8178	3·7	307·71	Hospital for Insane ...	Clinker of Claremont
Mokine Empire Lily 13th ...	Jersey ...	...	2-11-28	22-9-32	273	12	4986	5·3	264·39	T. H. Wilding ...	The Valley Twilish Fox
Woodendale Shirley	do. ...	28175	8-7-28	5-7-32	210	11½	4725	5·2	247·38	F. P. Atwell	Mokine Lady's Chief

COWS OVER 3 YEARS AND UNDER 3½ YEARS OLD—STANDARD 270 Lbs. BUTTER FAT.

Juadine Daisy 2nd	Jersey ...	34342	24-6-29	9-8-32	273	19½	8183	4·8	388·82	Miss L. Hancock ...	The Valley Twilish Fox
Claremont Star 2nd	A.I.S. ...	...	1-8-29	16-8-32	210	14½	6225	4·0	250·08	Hospital for Insane ...	Claremont Elector
Minnamurra Eleanor	Guernsey	2607	13-8-29	20-9-32	273	15	4875	4·0	213·02	Muresk Agricultural College	Caramara Favour

COWS OVER 2½ YEARS AND UNDER 3 YEARS OLD—STANDARD 250 Lbs. BUTTER FAT.

Burnside Myrtle	Jersey ...	...	29-10-29	26-8-32	273	15½	5807	5·0	293·23	E. D. P. Hayes ...	Minnamurra Prairie Don
Grassvale Golden Cream 3rd ...	do. ...	...	26-8-29	22-7-32	273	12	5586	5·2	289·62	R. H. Rose	Choice Goods of Garden Hill
Claremont Star 3rd	A.I.S. ...	5124	16-2-30	23-8-32	273	20½	6826	4·1	280·65	Hospital for Insane ..	Claremont Evan
Grassvale Choice Maid	Jersey ...	34812	10-10-29	5-9-32	273	18	4674	5·4	253·69	R. H. Rose	Choice Goods of Garden Hill
Claremont Maggie Morrison 8th	A.I.S. ...	5121	28-1-30	16-8-32	273	11½	5779	4·1	237·31	Hospital for Insane ...	Searchlight of Sunny Vale
Minathorpe Blanche 8h ...	do. ...	2474	20-10-29	10-9-32	273	8½	4840	4·8	224·17	R. Bee & Sons ...	Collier of Darbalara
Lonswood Lady Grey 9th ...	Jersey ...	...	14-9-29	27-8-32	273	9	4252	4·9	207·98	B. W. Prowse ...	Hamel Lea Fancy's Dapper
Tipperary Virginia 4th ...	A.I.S. ...	2379	18-8-29	17-8-32	150	28	4620	...	192·21	W. G. Burges ..	Melba's Re-Echo of Tipperary

COWS UNDER 2½ YEARS OLD—STANDARD 230 Lbs. BUTTER FAT.

Brookvale Bluebell	Jersey ...	...	21-6-30	17-7-32	273	14½	6073	5·06	303·54	G. F. Combs	
Longridge Bess	A.I.S. ...	5104	15-8-30	7-10-32	273	13	5439	5·10	284·89	R. Bee & Sons ..	Minnathorpe Kitchener
Glanavon Edna	do. ...	2353	10-7-30	23-9-32	273	13½	6115	4·5	269·01	D. Bevan .. .	Raleigh Regent
Brookvale Double Success ...	Jersey ...	...	24-7-30	19-7-32	273	14½	5923	4·4	262·69	G. F. Combs	
Mokine Empire Breakaway ...	do. ...	...	5-9-30	26-9-32	273	12	4656	5·3	250·12	T. H. Wilding ..	The Valley Twilish Fox
Claremont Lily 4th	A.I.S. ...	5120	1-3-30	28-8-32	273	11½	6274	3·8	248·44	Hospital for Insane ..	Searchlight of Sunny Vale
Glanavon Miranda	do. ...	2365	6-5-30	8-9-32	273	16	5703	4·2	238·03	D. Bevan	Pine Creek Dunbar
Glanavon Phoebe	do. ...	5144	17-9-30	17-8-32	273	16	5508	4·2	234·39	A. E. Grant	Raleigh Regent
Yanget Pansy	do. ...	5154	4-9-30	14-8-32	273	13	4694	4·3	204·10	A. E. Grant	Tipperary Headlight
Woodendale Duchess	Jersey ...	...	7-4-30	10-6-32	240	11½	3480	5·4	195·30	F. P. Atwell	Mokine Lady's Chief
Greenmount Beauty	do. ...	...	10-10-30	30-6-32	240	10	3675	4·5	166·80	F. P. Atwell	Granthams Starbright's King
Yanget Milkmaid	A.I.S. ...	2445	29-4-30	28-7-32	210	12½	3680	4·4	163·31	A. E. Grant	Baron of Darbalara
Glanavon Vilma	do. ...	2370	18-7-30	30-9-32	210	15	4065	.	162·48	D. Bevan	Pine Creek Dunbar
Glanavon Anne	do. ...	2360	24-7-30	13-9-32	210	10½	3390	.	138·33	D. Bevan	do. do.
Brookvale Lady	Jersey ...	...	2-3-31	18-9-32	210	11½	2730	..	127·32	G. F. Combs	
Greenmount Bo-Peep's Fancy ...	do. ...	...	21-6-30	27-8-32	180	9	2625	4·8	126·42	F. P. Atwell	Werribee Starbright King

"CONTROL OF BLACK SPOT OR SCAB OF PEARS IN WESTERN AUSTRALIA."

JOAN HEARMAN, B.SC.

ADDENDUM.

In connection with the article under the above title, which appeared in the last issue of this Journal (June, 1933, pages 292-316), it is desired to call attention to the following details, which were unfortunately overlooked in the rush of preparing the manuscript for publication.

1. *Use of calcium caseinate spray spreader with all sprays.*—Calcium caseinate was used as a spreader at the rate of one pound (1 lb.) to every hundred gallons (100 galls.) of "Lime Sulphur" and "Bordeaux Mixture" used in the experiments.

2. *Details of costs of spray materials.*—The costs estimated in the table on page 305 headed "Cost of Spraying" were based on the following prices:—

Bluestone—37s. 6d. per cwt. (approx. 4d. per lb.).
Quicklime—2s. 9d. per 38 lb. tin (0.87d. per lb.).
Spreader—10d. per lb.
Lime Sulphur—1s. 10d. per gallon.

3. That part of the summary dealing with the *control of the disease* has been extended, and now reads as follows (*the additions being given in italics*):—

Control of the Disease.

(i) The disease was effectively controlled on a property where it had been unusually serious for some years prior to these experiments.

(ii) Ploughing-in of over-wintered leaves early in the Spring, *i.e.*, before the buds burst, was an important factor in the control of the disease.

(iii) *Where no spray was used and the ground was ploughed early, i.e., before the "bud-bursting" stage, a good crop matured but was so badly diseased as to be unmarketable.*

(iv). *Where no spray was used and the ground was not ploughed early, the crop became so badly diseased that it fell off before maturity.*

(v) Bordeaux Mixture was more effective on both varieties used in the experiments, *i.e.*, Glou Morceaux and Beurre Bosc, as a spray to control "Black Spot" of pears than Lime Sulphur, because it retained its protective qualities over a much longer period than did Lime Sulphur. *Calcium caseinate was used as a spreader in all sprays. No noticeable spray injury of any kind was caused to the fruit at any time.*

(vi) Four sprayings with Bordeaux Mixture applied at the "green-tip" (5:4:50), "pre-pink" to "pink," "petal-fall" and "10 days later" stages (all 3:4:50), *following early ploughing*, gave very good control of "Black Spot." (79 per cent. perfect Glou Morceaux fruit; 89.5 per cent. marketable.)

(vii) A spraying with Bordeaux Mixture (3:4:50) applied one month later improved the control (89 per cent. perfect Glou Morceaux fruit; 93 per cent. marketable).

(viii) One spraying with Bordeaux Mixture (5:4:50) in the early "pre-pink" stage had some effect in controlling the disease, even when the ground was not ploughed early.

(ix) A spraying in the previous autumn *with Bordeaux Mixture 6:4:50* or *Lime-Sulphur 1 to 15*, did not appear to contribute to the control of the disease in these experiments, in which the trees were heavily infected at the time of the application.

(x) The cost of material for four applications of Bordeaux Mixture was 3.56 pence per tree.

(xi) *The total crop carried by the trees in the experimental plots, with the exception of those mentioned in paragraph (iv), averaged seven (7) Australian bushel ("dump") cases per tree on the Beurre Boscs and three (3) Australian bushel cases per tree on the Glou Morceaux.*

The above amendments have been made in the reprinting of the article which has been issued as Leaflet No. 380 of the Department of Agriculture of W.A. Copies of the leaflet are obtainable free of charge on application to the Department.

A REVIEW.

THE INSECT BOOK.

We have received from the Shakespeare Head Press Ltd., of Sydney, an admirable little book on insects by Walter W. Frogatt, formerly Government Entomologist to the New South Wales Government. This is published in a handy size edition suitable for the student of entomology, containing a brief but lucid description of insects, and points out the damage done by those not included in the category of "friendly insects." There are numerous illustrations depicting the phases, life and habits of the insect world, and reference to this little volume should enable the easy identification of those which commonly meet the eye. While the work does not deal with eradication methods particularly, it does point out succinctly the form of damage caused by the character and habits of destructive insect pests.

THE TREE BOOK.

From the same publishers we have another similar work dealing with Trees, and entitled "The Tree Book". This is a compact edition by David G. Stead, and imparts to the reader a fund of information on the classification of Australian bushlands, explaining in a simple way the character and relationship of our native trees, tree zones, uses and nature of timbers, and also the beautification of the landscape. Each subject is dealt with in a brief chapter full of pith and clarity. To the student, the bush-lover and the traveller this work is highly commended.

Both these publications form part of a series of Nature books issued by the publishers, and are on sale at a retail price of 2s. each.

THE VALUE OF MANGANESE AS A FERTILISER IN WESTERN AUSTRALIA.

BY

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A. J. HOARE,* Government Chemical Laboratory.

I. THOMAS, Department of Agriculture.

INTRODUCTORY.

Manganese and Plant Growth.

Scientific discoveries and progress in practice have always been supplementary, and it is often very difficult to evaluate the separate contributions of the scientific and practical outlook in any problem. Experience shows that progress is made possible by the observation of facts and the use of those facts, and deductions arising therefrom, in everyday problems. Observations on the effect of nitre on plant growth led to the establishment of an enormous industry in nitrogenous fertilisers. The invention of the microscope made possible the development of the science of bacteriology. Stimulation in research has always been obtained from the recognition of the needs of mankind and the desire to know nature better.

The knowledge of the importance of manganese in plant growth has developed from the observation by Scheele, in 1785, that the ash of the plant, "wild anise", contained manganese. Its practical significance was not realised until the beginning of this century when field and pot experiments demonstrated a response in crop growth to the use of manganese salts as fertilisers on certain soils. Although this stimulation in growth was observed in many places, particularly in France, Italy and Japan, the effect was far from general. Kelley (1912), reviewing the situation, concluded that the use of manganese salts as fertilisers could not generally be recommended. Since that time the position has been studied by scientists throughout the world and it is now known that manganese is a factor to be considered in crop production only under certain restricted conditions in most countries.

1. *Manganese as an injurious factor.*

Excess of manganese has been found to exert an injurious effect on pineapples in Oahu, Hawaiian Islands, causing chlorosis by immobilisation of iron (Johnson 1924). Bare patches in couch grass lawns, and failure of patches in barley crops have been correlated by Cohen (1910) and Guthrie and Cohen (1909) in New South Wales, with variations in soil manganese.

Used as a fertiliser, applications in excess of about 100 pounds per acre are liable to cause crop injury.

2. *Conditions favouring crop response to manganese as a fertiliser.*

While manganese does not appear to be lacking in availability in soils in most cases, conditions have been defined under which marked response is observed when used in small amounts as a fertiliser or spray.

*Assisted by R. G. Lapsley, B. L. Southern and F. W. Steel.

(a) *Alkalinity in soil reaction.*

Chlorosis of crops on heavily-limed soils is known as "lime-induced chlorosis" and has been observed in many parts of America. The condition is due to the rendering of the soil manganese unavailable by adjusting the soil reaction to a value between pH 7.0 and pH 9.0. Under these conditions a control is effected by the use of 28 to 56 pounds of manganese sulphate per acre as a fertiliser or by spraying with manganese sulphate in solution at the rate of 8 pounds per acre.

On some soils, naturally alkaline, certain diseases have been proved to be due to unavailability of manganese. "Roadside Take-all" of oats at Mt. Gambier, and failure of barley at Corny Point, South Australia, have been prevented by use of manganese sulphate as a fertiliser. Phenomenal increases in yield of tomatoes and truck crops have been obtained in the calcareous everglades in Florida by the use of small annual applications of manganese.

(b) *Oxidising conditions.*

Highly oxidising conditions depress manganese availability. Readily decomposable organic matter and water-logging tend to raise the availability of soil manganese. Thus, the use of manganese on the Florida everglades obviates the need for heavy applications of farm-yard manure. Water-logging increases water soluble and replaceable manganese and leads to increased absorption of that element by plants (Godden and Grimmett (1928)).

(c) *Soil poverty with respect to manganese.*

In some soils the manganese content is so low that response to its use as a fertiliser would be expected.

MANGANESE IN THE SOIL.

Manganese occurs in igneous rocks and the old recrystallised sediments (metamorphic schists) as a partial substitute for the iron of such ferruginous minerals as hornblende, pyroxene, biotite and chlorite, all of which are complex silicates. In limestones and dolomites it is present as manganese carbonate in combination with the carbonates of lime and magnesia. In recent sediments and in soils it is mostly present as psilomelane, a compound of manganese oxides, potash and water. Clarke (1924) page 34 estimates the composition of the earth's crust with respect to manganese as follows:—

Igneous rocks	0·096% manganese
Limestone rocks	0·040% manganese
Weighted average	0 091% manganese

This manganese is the source of that in soils. In soils, manganese generally occurs to the extent of a few hundredths of a per cent., the range being from a trace to 7 per cent. Figures showing the findings of various investigators are later compared with the results of this investigation. (Tables 5 and 6.)

Probably the most important fractions of the soil manganese, as far as the plant is concerned, are the water soluble fraction, and the fraction in the soil clay existing in the replaceable condition, *i.e.*, rendered soluble by treatment with solutions of neutral salts such as ammonium chloride or sodium chloride.

The replacable manganese usually varies from a trace to 0.06 per cent. manganese on the dry soil basis. Schollenberger and Dreibelbis (1930) found that 30 years of cropping reduced this fraction from 0.0245 per cent. to 0.0074 per cent. Liming was even more potent in reducing this fraction than cropping. Piper (1931), studying the effect of the addition of manganese sulphate on the soil, detected 20 per cent. of the added manganese in the replaceable form after 4 weeks, the remainder apparently reverting to the more inert oxidised state. Water-logging causes a chemical reduction of the more inert soil manganese and results in a substantial increase in replaceable manganese as well as water soluble manganese.

This condition is correlated with improved crop returns following temporary water-logging of soils deficient in available manganese. Piper's (1931) results are cited in Table.

TABLE 1.—EFFECT OF WATER-LOGGING SOILS DEFICIENT IN AVAILABLE MANGANESE ON YIELD OF OATS.

Soil.	Yield of Normal Soil.		Yield from Soil following Water logging for one week.	
	Gms. per Pot.	Per cent.	Gms. per Pot.	Percentage of Normal Soil.
Mt. Gambier	1·5	100	75·0	5 000
Penola	15·2	100	23·4	154
Corny Point	6 3	100	55·8	885

EXPERIMENTAL.

In view of the results observed in South Australia (reported by Samuel & Piper (1928) (1929) and Scott (1932)) two tons of manganese sulphate were made available for trial in Western Australia in 1931. Experiments were arranged throughout the agricultural areas on State Experiment Farms and on private farms.

Already Caine (1927) had reported the finding of the "Grey Speck Disease" at Dwarda and the disease had been observed in various parts of the southern portion of the wheat belt, generally in association with powdery soils of mallet (Eucalyptus astringens) hills. In this investigation experiments were arranged on a wide variety of soils, particular attention being paid to highly calcareous types. Crops tested included wheat, oats, and pasture, and representative soils were examined chemically for manganese content.

The accompanying map shows the isohyets, railways, and principal towns and districts of the Agricultural portion of the State in addition to the centres at which experiments were conducted.

THE SOILS INVESTIGATED.

The soils investigated fall into the following groups:—

(A) Soils of the mallee zone of the wheat belt associated principally with Salmon gum (E. salmonophloia), gimlet (E. salubris) and morrel (E. longicornis) timber.

(B) Brown earth soils of the jam (Acacia acuminata) and York gum (E. fœcunda var. loxophleba) belt.

(C) Soils of the clover belt in the high rainfall area of the South-West characterised by timber including jarrah (E. marginata), marri or red gum (E. calophylla) and karri (E. diversicolor).

(D) Sandy lateritic scrub plain soils represented by the Wongan Hills Light Land Experiment Farm.

(E) Powdery soil carrying mallet (E. astringens) from Dwarda.

CHEMICAL AND PHYSICAL PROPERTIES OF THE SOILS.*

The chemical and physical characteristics of representatives of the various soils studied in these groups are summarised in Tables 2, 3 and 4. Further information concerning the salmon gum and gimlet loam of Merredin is given by Prescott (1931) and Sutton (1920). In the latter paper analyses of jam soils from the Chapman Experiment Farm are also cited.

*Chemical work executed in the Government Chemical Laboratory by A. J. Hoare and Associates.

TABLE 2.—CHEMICAL, PHYSICAL, AND OTHER CHARACTERISTICS OF SOILS OF THE MALLEE GROUP.

District.	Farmer.	Rainfall f 1 1.	Soil Profile.	Characteristic Timber.	Chemical properties 0—9" layer (percentage dry soil). Water Soluble Salts (average).	pH.*	$CaCO_3$.	Manganese Soluble in Concen. HCl.
		inches.			per cent		per cent.	percentage Mn.
Merredn	Experiment Farm...	12·25	Red brown loam on calcareous clay	Salmon gum, gimlet...	0·076	8·31	0·227	0·031 ± ·0105*
Southern Cross ...	Experiment Farm ...	10·19	do. do. do.	do. do. ...	.	..	..	0·022 ± ·0036*
Nungarin	Johnson	12·72	do. do. do	do. do. ..		..	...	0·029
Lake Carmody ...	Boulton	14 88	Brown loam on calcareous clay	Gimlet and merrit ..	..	...	...	...
Lake Biddy ...	Sandells	11·71	Calcareous sandy loam	Salmon gum, morrel ..	...	..	3·70	0·016
Lake Grace ...	McMahon	14 59	Grey calcareous loam	Kendinin blackbutt ..	.	...	..	0·025
Lake Varley ...	Abernethy 4A ...	..	Grey brown calcareous sandy loam	Morrel ..	NaCl (%)— 0·061	...	2 88	0·017
Do. ...	Abernethy 4B ...	...	do. do. do	do . ..	0 102	..	4·91	0·037
Do. ...	Abernethy 4BA ...	...	do. do do. ...	do.	0·057	..	5·14	0·016
Lake Brown ...	Meston	9·41	do do. do. ...	do.	..	..	...	...
Do. ...	Mulqueeny ...	9·41	do. do. do. ...	do.	..	..	4·40	0·0648
Nungarin	Herbert	12·72	do do. do. .	do.	...	...	..	...
Salmon Gums ...	Experiment Farm ...	16 69	Light brown sand on calcareous clay	Mallee scrub	Water sol salts (%)— 0 200	8 14	2 14	0·0052 ± ·0031*
Scaddan	Grigg	20 53	Heavy clay	do.	...	...	...	...
Dampawah ...	Experiment Farm ...	11·87	Red loamy sand	York gum, yorrel. etc	.	...	...	..
							Average ..	0·026

*Standard error calculated from $\sqrt{\frac{\Sigma d^2}{n-1}}$

* pH. determined on 1—1 suspension, by Quinhydrone method.

TABLE 3.—CHEMICAL, PHYSICAL, AND OTHER CHARACTERISTICS OF SOILS OF THE JAM, YORKGUM GROUP.

District	Farmer.	Rainfall for 1931.	Soil Profile.	Vegetation.	Chemical Properties 0—9" layer (percentage dry soil).	
					pH.*	Manganese Soluble in Conc. HCl.
		inches.				percentage Mn.
Nabawa	Chapman Experiment Farm ...	20·09	Brown loamy sand on clay	Jam, wattle, and york gum ...	7·32	0·0275
Beverley	Avondale Experiment Farm ...	18·51	Brown loam on clay	York gum, jam...	...	...
Muresk	Agricultural College	18 14	Brown loam on clay	York gum, jam...	..	...
Southern Brook ...	Bostock	14·48	Loam on clay	Salmon gum	...	0 017*
Do. ...	do.	14·48	Sand	Jam and scrub	..	0·0036*

* to 20 inches deep.

TABLE 4.—CHEMICAL, PHYSICAL, AND OTHER CHARACTERISTICS OF SOILS OF OTHER GROUPS.

District.	Farmer.	Rainfall for 1931.	Soil Profile.	Vegetation	Chemical Properties (percentage dry soil.)				
					Water Soluble Salts (average).	pH.*		Manganese Soluble in Concen. HCl.	
		inches.			per cent.	0–9"	9–18"	percentage Mn. 0–9"	9–18"
Busselton ...	State Farm (Sabina Vale)	32·59	Sandy loam	Red gum, blue gum. banksia ...	...	6·35	5·72	0·022	0·023
Do.	do. do. ...	32·59	Heavy soil	do. do. do. ...	...	4·30	4·30	0 0006	0·001
Northcliffe ...	Bennett (loc. 9911) ...	59·37	do.	Karri, red gum. casuarina	...	7·08	6·31	0·016	0·083
Do. ...	Thompson (loc. 10282) ...	59·37	Grey sand	Bottle brush, blackboy	...	6·49	6·52	0·077	0·061
Dwarda	O'Connell	29·27	Powdery calcareous loam	Mallet	...	6·48		0·018*	
Wongan Hills ...	Experiment Farm ...	12·91	Grey sand on gravelly clay	Low scrub	0·078	6·02		0·0011†	

* Precipitation as Mn_3O_4. † Average of determinations on 15 separate samples.

* pH. determined on 1—1 suspension, by Quinhydrone method.

It is seen that the range is from calcareous loams of the wheat belt to acid soils of the clover belt. The content of manganese soluble in concentrated hydrochloric acid varies from a *bare trace* to 0.077 per cent. of the dry soil.

To complete the picture, these results, together with figures from analyses of Western Australian soils in connection with other projects, are compared with analyses reported from other parts of the world in Table 5. A comparison of the water soluble and replaceable manganese content of soils from various parts of the world is made in Table 6.

TABLE 5.—COMPARISON OF MANGANESE CONTENT OF SOILS IN WESTERN AUSTRALIA WITH SOILS OF OTHER PARTS OF THE WORLD.

Worker	Country or District	No. of Samples Analysed.	Soil Manganese (percent. Mn dry soil).	
			Total Manganese (fusion).	Manganese Soluble in conc. HCl.
FOREIGN—			per cent.	per cent.
Sullivan & Robinson (1912)	United States of America ...	26 (averaged)...	0·055	...
Robinson (1929) .	United States of America and Philippines	57 „ .	0·290	...
Robinson & Holmes (1924)	United States of America . .	34 „ ...	0·0952 (0·0008– 0·496)	...
Emmert (1931) ..	Kentucky	5 „ .	0·226 (0·045–0·420)	...
McGeorge (1929) ...	Hawaiian Islands	20 „ ...	...	0·079
Do	do. . .	1 „ ..	.	3·26
EASTERN STATES OF AUSTRALIA				
Piper (1931)	South Australia (Mt. Gambier)		. .	0·032
	(Penola) ..	...	..	0·005
	(Corny Point)	. .	...	0·019 0-9" layer
WESTERN AUSTRALIA—				
The Authors ...	Salmon gum, morrel and mallee soils	73 (averaged)...	...	0·023
	Jam and york gum soils ...	2 „ ...	0·0302	0·026
	Clover belt soil (high rainfall)	4 „ ...	..	0·029
	Mallet soils—Dwarda (1931)	4 „ ...	. .	0·018
	Scrub plain soils—Wongan Hills	15 „ ...	. .	0·0011 (nil to 0·0027)
	Merredin Experiment Farm	15 (composited)	0·0302	0·0275
	Abernethy's morrel country	12 „ ...	0·0410	0·0356
	Mulqueeny's morrel country	4 „ ...	0·0734	0·0648
	Sandell's morrel country ...	4 „ ..	0·0184	0·0186
	Chapman Experiment Farm	15 „ ...	0·0302	0·0275
	Wongan Hills Experiment Farm	15 „ ...	0·0032	0·0032
Government Chemical Laboratory	Mallet soils—Dwarda (1926)	3 (averaged)...	...	0·018
Do. ...	Denmark (1928)	3 „ ...	...	0·038 (0·018 to 0·054)
Do. ...	Salmon Gums Experiment Farm (1929)	1 (Serial No. 49)	...	0-6" 0·006 6-24" 0·007 24-28" 0·007
Do. ...	Lake King (morrel type) ...	1 (Surface and subsoil averaged)	...	0·026

TABLE 6.—WATER SOLUBLE AND REPLACEABLE MANGANESE IN SOILS AND THE EFFECT OF WATER-LOGGING, LIMING, CULTIVATION, ETC., ON THESE FRACTIONS.

Worker.	Soil.	Treatment.	pH.	Water Soluble Manganese. Manganese (Mn) in Dry Soil.	Replaceable Manganese. Manganese (Mn) in Dry Soil.
UNITED STATES OF AMERICA—				p.p.m.	p.p.m.
Metzger (1931) ..	Clarkville silt loam	Air dry	...	...	318
	do. do.	Flooded	...	...	420
	Crawley rice soil	Virgin	...	...	305
	surface	Irrigated	...	...	331
	Crawley rice soil	Virgin	...	...	26
	subsoil	Irrigated	...	...	262
Schollenberger and Dreibelbis (1930)	Wooster silt loam	Virgin	Acid	...	245
		Cultivated 30 years ...	„	...	74
		Cultivated + lime ...	..	...	11
Schollenberger (1928)	Wooster silt loam	Untreated	„	...	55
		Water-logged	„	...	440
		Water-logged + starch	„	..	580
EASTERN STATES OF AUSTRALIA—					
Piper (1931) ...	Mt. Gambier .	Untreated ...	8·07	Trace	4·2
		Water-logged	...	1·9	...
		Water-logged + dextrose	...	5·45	...
		Water-logged + aeration	..	0·05	...
	Penola	Untreated	6·9	Trace	...
		Water-logged	..	0·08	..
		Water-logged + dextrose	...	0·32	...
	Glen Osmond ...	Untreated	7·4	Trace	65·7
		Water-logged	.	6·3	...
		Water-logged + dextrose	.	13·0	...
		Water-logged + aeration	..	3·0	...
WESTERN AUSTRALIA—			*		
The Authors ..	Merredin Experiment Farm	Normal	7·82	3·2	111
		Waterlogged ..	7·43	15	139
	Abernethy's morrel country	Normal ...	8·01	4·3	23
		Waterlogged	7·58	14	46
	Mulqueeny's morrel country	Normal	8·08	5·4	70
		Waterlogged	7·61	8·6	128
	Sandell's morrel country	Normal .. .	7·70	3·2	26
		Waterlogged	7·48	7·6	37
	Chapman Experiment Farm ..	Normal	7·02	5·4	156
		Waterlogged	7·02	41	203
	Wongan Hills Experiment Farm	Normal	6·10	2·2	13
		Waterlogged	6·97	8·6	19

* pH. determined on 1—1 suspension, by Quinhydrone method.

On the average the Australian soils investigated are lower in total and replaceable manganese than soils of the United States of America, the Hawaiian Islands and the Philippine Islands. There does not appear to be any serious general deficiency, however, except in such soils as the sandy lateritic scrub plain soils represented by the Wongan Hills Experiment Farm and, perhaps, swamp soils of the type represented at Penola, South Australia. The magnitude of the water soluble and replaceable fractions indicates that the general condition of the manganese with respect to availability appears to be normal. Furthermore, short periods of water-logging, in this case, one week, lead to significant increases both in water soluble and replaceable manganese. As suggested by Piper (1930), this behaviour may be quite important agriculturally, for such soils as the calcareous morrel soils, being relatively rich in organic matter, may thus respond sufficiently to the winter

rains to provide the available manganese necessary for crop growth. The behaviour of the mallet soils at Dwarda points in the same direction. In these experiments the response to manganese fertiliser (Table 9) occurred only in the cold winter months. With the advent of moist and warm spring weather the control plants recovered from the symptoms of manganese deficiency and made growth equal to that on the plots treated with manganese sulphate. The availability of the low percentage (0.018) of manganese in this soil is apparently adequate for the growth of wheat or oats under favourable climatic conditions.

Of particular interest is the lateritic soil from Wongan Hills, which shows an abnormally low manganese content. Of the fifteen samples analysed to represent this soil, six showed no visible reaction for hydrochloric acid soluble manganese and the highest figure recorded was 0.0027 per cent., approximately one-tenth the average figure for the Western Australian soils examined. The content of replaceable manganese, determined on the composited sample, was only 13 p.p.m., and this fraction was raised only to 19 p.p.m. by water-logging.

This response is much lower than normal and suggests a low availability of the manganese as well as a poverty with respect to absolute amounts. It is of significance that these chemical data should be correlated with a significant, if small, response to manganese as a fertiliser.

The analysis of the soil from the Chapman Experiment Farm shows a concentration of 41 p.p.m. water soluble manganese in the water-logged sample. As these soils are very subject to water-logging in winter, there is a possibility of manganese injury being experienced during this period. This affords an additional argument in favour of farm drainage is those districts suffering from excess winter rains.

THE FIELD EXPERIMENTS.

A. *Experiments on private farms with wheat.*

These experiments were arranged particularly to afford data concerning the effect of manganese sulphate on calcareous soils of the Eastern wheat belt, which had carried morrel (E. longicornis) in the virgin state. This type of soil is rich in plant requirements, but is of poor physical condition, being very powdery when dry, and is high in calcium carbonate even in the surface horizon, resembling, in these respects, the manganese-deficient soils of Corny Point, South Australia. While it is generally regarded as unsatisfactory wheat land except under conditions of very favourable rainfall, it will carry a heavy growth of such forage as barley grass (Hordeum murinum). With proper farm management, involving stock husbandry and shallow cultivation to effect consolidation, certain types of morrel country produce quite good crops of wheat even under the low rainfall conditions of the Eastern wheat belt. It was felt that these soil conditions would favour a positive response to manganese fertilisation.

To control the experiments on morrel country, and also the rather similar blackbutt (E. Kondininensis) country, collateral experiments were organised on typical salmon gum, gimlet and mallee soils. In these soils the profile is normal, showing a non-calcareous surface loam (A horizon) with a good subsoil rich in clay and calcium carbonate. The general properties of the soils of these plots are tabulated in Tables 2, 3 and 4 above.

The experiments were arranged on fallowed land (with one exception) and the plots were laid out and the seeding supervised by technical officers of the Department of Agriculture. Conditions of planting conformed as nearly as possibly to the best practice of the wheat belt with respect to wheat variety, time of seeding, preparation of the seed bed and fertiliser treatment. Generally four one-quarter acre plots, separated by buffer plots to facilitate harvesting, were pegged and sown as follows:—

1. *Control*: Plots 1 and 3; seed and 112 lbs. of 22 per cent. superphosphate per acre.

2. *Manganese treatments*: Plots 2 and 4; seed and 112 lbs. of 22 per cent. superphosphate plus 56 lbs. of manganese sulphate per acre.

Owing to a hitch in the arrangements, on the farms of Messrs. Meston and Mulqueeny, of Lake Brown, the manganese sulphate was used as a top dressing on July 3rd and July 1st respectively instead of being applied with the seed at planting in May. Mr. Mulqueeny's plots were on unfallowed stubble land.

The results of the thirteen experiments with wheat on ten farms are reported in Table 7.

TABLE 7.—THE EFFECT OF MANGANESE SULPHATE AS A FERTILISER ON THE YIELD OF WHEAT IN TRIALS CONDUCTED ON PRIVATE FARMS, 1931.

All Plots received 22 per cent. Superphosphate at approximately 112 lb. per acre. Manganese Sulphate was applied at the rate of 56 lbs. per acre.

District.	Farmer.	Principal Native Vegetation.	Superphosphate and Manganese.			Superphosphate—Control.		
			Plot 2	Plot 4.	Average Yield as per cent. of Control.	Plot 1.	Plot 3.	Average Yield as 100 per cent.
Southern Brook	Bostock .	Salmon gum ...	Yields reported to be the same by Group Settlement Department.					
Do. ..	do. ..	Jam and scrub	Yields reported to be the same by Group Settlements Department.					
			bus. lb.	bus. lb.	%	bus. lb.	bus. lb.	%
Lake Varley ...	J. Abernethy ..	Morrel (4A) ...	7 17	5 45	88	9 24	5 22	100
Do. ...	do. ...	Morrel (4B) ...	5 56	8 34	123	5 22	6 26	100
Do. ...	do. ...	Morrel (4BA)...	19 0	21 3	105	18 26	19 22	100
Lake Brown ..	Meston 1 ...	Morrel ...	9 20	12 32	92	10 56	12 52	100
Do. ...	Mulqueeny 2 ...	do. ...	9 52	10 16	101	9 28	10 28	100
Nungarin ...	G. Herbert ...	do. ...	18 24	17 16	96	19 18	17 48	100
Lake Grace ...	McMahon ...	Blackbutt ...	14 24	15 4	100	14 40	14 44	100
Lake Biddy ...	Sandells ...	Salmon gum and morrel	10 36	7 20	96	10 4	8 32	100
Nungarin ...	Johnson ...	Salmon gum ...	22 24	22 58	103	21 40	22 20	100
Lake Carmody	Boulton ...	Gimlet and Merritt	32 4	30 48	100	32 20	30 20	100
Scaddan ...	Grigg Bros. ...	Mallee scrub ...	15 44	16 0	104	15 28	15 4	100
	Average percentage Yield ...		...	...	101	...	...	100

The maximum positive effect observed was 23 per cent.; the maximum negative effect, 12 per cent., both from the same paddock on morrel soil (Abernethy, Lake Varley). These differences are undoubtedly attributable to soil variability and are deemed not significant.

It is concluded that treatment with manganese sulphate as a fertiliser is ineffective under the conditions of these experiments.

The average percentage yield *with* manganese sulphate is 101 as compared with the controls reckoned at 100. Considering the experiments on morrel and blackbutt soils alone, the average yields of the controls and the treated plots are practically identical.

Additional interest is attached to the three sets of experiments on Mr. J. Abernethy's farm at Lake Varley. Each set was arranged on morrel and boree country in the same paddock to ascertain the effect of manganese sulphate on soils variously affected with alkali or excess of water soluble salts. All plots were on new land fallowed. The set of plots designated 4B were on powdery, highly calcareous soil, which was badly affected with alkali. Those designated 4BA were on very similar soil physically, but relatively free of alkali. Plots designated 4A were on soils somewhat more sandy, less powdery, lower in calcium carbonate in the surface, and also relatively free of alkali as compared with those designated 4B.

The striking difference in yield between plots 4B and 4BA is correlated with the occurrence of soil alkali, and it is apparent that manganese sulphate as a fertiliser had little effect on the tolerance of wheat for soil alkali. No explanation of the low yields on plots 4A can be offered.

B. *Experiments on the State Experiment Farms.*

On the seven Experiment Farms of the wheat belt and at the Muresk Agricultural College more critical experiments were conducted, using the usual methods employed by the Department of Agriculture on the State Experiment Farms. A wide and representative range of climatic conditions and soil types occur in this list and the results supplement the experiments on the private farms in the wheat belt. The general properties of the various soils represented by these farms are tabulated, with others, in Tables 2, 3, and 4 above.

Fertiliser treatments used in this experiment on each farm were—

1. 112 lbs. of superphosphate per acre.—*Control.*
2. 112 lbs. of superphosphate plus 28 lbs. of manganese sulphate per acre.
3. 112 lbs. of superphosphate plus 56 lbs. of manganese sulphate per acre.

Each treatment was replicated five times and the plots were arranged on the three plot system. Each plot was one-eighth of an acre in area.

The details of the results from the Experiment Farms are reported by Thomas and Langfield (1932) for the Merredin Experiment Farm, Thomas and Shier (1932) for the Chapman Experiment Farm, Thomas and Prunster (1932) for the Yilgarn Experiment Farm, Thomas and Venton (1932) for the Wongan Hills Light Lands Farm, Thomas and Seinor (1932) for the Salmon Gums Experiment Farm, Wild and Bailey (1932) for the Avondale Experiment Farm, and by Hughes and Riches (1932) for the Muresk Agricultural College.

The results, treated statistically according to the method of Engledow and Yule (1926), are summarised in Table 8.

TABLE 8.—SHOWING THE YIELD OF WHEAT AND OATS AS AFFECTED BY APPLICATION OF MANGANESE SULPHATE AS A FERTILISER IN ADDITION TO SUPERPHOSPHATE, ON THE EXPERIMENT FARMS, WESTERN AUSTRALIA, 1931

Each Yield is the Average of the Yields from the Five Plots under each Treatment

Farm.	Seed.		Fertiliser		Wheat Yield per Acre.				Chance of difference from Control being due to Manganese Treatment.	Statistical Significance of Differences.
	Variety.	Rate. (lbs per acre.)	Superphosphate. (lbs. per acre)	Manganese Sulphate. (lbs. per acre.)	Bus.	Lbs.	Standard Error of Mean Difference lbs	Per cent.		
Merredin	Gluyas Early Wheat	45	112	Nil	21	28	± 28·6	100		Not significant
		45	112	28	21	52	.	102	60 per 100 ..	
		45	112	56	21	31	.	100	20 per 100	
Chapman	Nabawa Wheat ...	60	112	Nil	20	37	14·3	100	... ..	Significance very doubtful
		60	112	28	21	9	..	103	97 5 per 100	
		60	112	56	21	7	..	103	96·4 per 100	
Wongan Hills ..	Nabawa Wheat ..	45	135	Nil	16	22	21·6	100	Control ..	Significant.
		45	135	26	17	47	..	109	99·9 per 100	
		45	135	52	17	49	..	109	99·991 per 100	
Yilgarn	Noongaar Wheat ...	30	95	Nil	17	12	27·9	100	Control ...	Significance doubtful.
		30	95	26	18	32	...	108	99·4 per 100	
		30	95	52	17	54	...	104	83·8 per 100	
Salmon Gums ...	Gluyas Early Wheat	45	112	Nil	13	31	30·3	100	Control	Not significant.
		45	112	28	12	53	...	95	79 per 100	
		45	112	56	12	29	...	92	96 per 100	
Dampawah ...	Gluyas Early Wheat	45	112	Nil	11	20	12 0	100	Control	Significance doubtful.
		45	112	28	11	18	...	100	10 per 100	
		45	112	56	11	57	...	105	99·8 per 100	
Avondale	Nabawah Wheat ..	60	112	Nil	15	52	38 6	100	Control	Not significant.
		60	112	28	15	20	..	97	60 per 100	
		60	112	56	15	2	...	95	79 per 100	
Muresk	Nabawah Wheat ..	60	112	Nil	21	58	57 7	100	Control ..	Not significant.
		60	112	28	22	48	...	104	61 per 100	
		60	112	56	22	48	...	104	61 per 100	
Muresk	Mulga Oats	60	112	Nil	53	8	14·8	100	Control ...	Not significant.
		60	112	28	52	37	..	99	6 per 100	
		60	112	56	48	6	..	90	82 per 100	

From this summary it is apparent that only at the Wongan Hills Light Lands Farm, has manganese sulphate had a statistically significant effect on the yield of wheat. There the average increase in yield was one bushel twenty-six pounds of wheat per acre or nine per cent. of the yield of the control plots. The increases in the average yields, observed at Chapman, Yilgarn, and Dampawah, are of very doubtful significance.

It is striking that the only definitely significant result has been observed on the slightly acid sandy surfaced, lateritic soil of Wongan Hills, which is practically virgin, having been cropped only once previously. This observation is correlated with an extremely low content of hydrochloric acid soluble, total and replaceable manganese. The average content of concentrated hydrochloric acid soluble manganese of the 15 samples from the Wongan Hills plots was 0.0011 per cent. Mn. Six of the samples gave no visible test for manganese and the highest figure obtained was only 0.0027 per cent. in the surface 9 inches of soil. Furthermore, the water-logging of this soil had but small effect on the normally low fraction of replaceable manganese. This poverty in manganese, undoubtedly a reflection of the history of this lateritic soil, may result in reduced crop growth, particularly in patches of exceptional deficiency, and thus be correlated with a positive response to manganese sulphate as a fertiliser. It will be of great interest to study the response to manganese after a considerable period of cultivation and cropping of this interesting soil type.

C. *The experiments in the clover and pasture belt.*

Certain observational trials were conducted in the higher rainfall areas, by the Dairy Branch of the Department of Agriculture and the Group Settlements Department, to determine the effect of manganese sulphate on pasture and hay crops. The results have been obtained from Department files and acknowledgment is made to the officers concerned for the information made available.

The reports of the officers observing the treatments are summarised in Table 9.

TABLE 9—OBSERVED RESULTS OF THE EFFECT OF MANGANESE SULPHATE AS A FERTILISER SUPPLEMENTING SUPERPHOSPHATE FOR PASTURE.

Farm	District	Soil Texture	Native Vegetation	Crop.	Observed Effect of Manganese.
5416 ..	Group 113 Denmark	Coarse sand	Sheoak, banksia, jarrah, bottlebrush	Pasture ..	None discernible.
2468 ...	do. ..	Sand ..	Bottlebrush, teatree	do ...	do
Denmark Stud Farm	Denmark ...	Sandy loam	Karri ...	Oats, barley and pasture	do
Clifton ...	Australind ...	do. ..	Tuart and peppermint	... .	do.
	Group 136, Busselton	Red sand ...	... ...	Pasture ...	do
O'Connell ...	Dwarda ..	Powdery calcareous loam	Mallet (E. astringens), etc.	Oats ..	No difference in yield. Manganese produced healthier appearance early in season.
Bennett (Loc. 9911)	Group 100, Northcliffe	Heavy soil ...	Karri, red gum, casuarina	Oats and pasture	None discernible.
Thompson(Loc. 10280)	Group 128, Northcliffe	Grey sand ...	Blackboy, bottlebrush	Oats and pasture	do.
Sabina Vale State Farm	Busselton ...	Sandy loam	Red gum, blue gum, banksia	do	Early growth of oats appeared superior: grain yield and pasture growth showed no difference at harvest.
Do. ...	do. ...	Heavy soil ...	do do.	do. ..	do. do.

No observable response to the use of manganese sulphate in addition to superphosphate was noted in any case. The response early in the season at Dwarda, on soils shown to be deficient in available manganese by Carne (1927) and liable to the "Grey Speck Disease", did not persist after the cold winter months had expired.

SUMMARY AND CONCLUSIONS.

A study of the extensive literature on manganese in relation to crop growth has shown that, under certain circumstances, crops respond to dressings of soluble manganese salts as fertilisers and sprays, owing to the *unavailability* of this essential element in the soil.

The factors contributing to unavailability of soil manganese include—

1. A neutral or alkaline soil reaction, particularly following heavy dressings of lime.
2. A high state of oxidation of the soil manganese.
3. Actual dearth of manganese in the soil.

In view of phenomenal responses of crops (particularly oats and barley) to dressings of manganese sulphate on certain soils at Mt. Gambier, Penola and Yorke's Peninsula in South Australia, a comprehensive set of experiments with this salt was arranged in Western Australia in 1931. It was desired to ascertain the effect of manganese sulphate under a wide range of representative soil and climatic conditions.

Particular attention was given to the alkaline and calcareous soils of the wheat belt. In connection with the field experiments arranged, soil samples were collected and examined in order to afford data concerning the manganese contents of Western Australian soils.

It was found that the Western Australian soils studied are all relatively low with respect to manganese soluble in hydrochloric acid. The mallee, jam, and scrub and lateritic soil types appear to be lowest in this element.

Chemical investigations showed that the manganese in the soils studied responded normally, chemically, to the treatments to which they were submitted, and that, except in the case of the lateritic soil from Wongan Hills, the soils were not significantly deficient in manganese.

With wheat, pasture and hay crops there appeared no signficant response in growth to manganese sulphate when used as a fertiliser at the rates of 28 and 56 pounds per acre under field conditions, except in the case of the lateritic soil from Wongan Hills.

A statistically significant increase in wheat yield of one bushel 26 lbs. per acre was observed at Wongan Hills on these acid lateritic soils which proved to be of exceptionally low manganese content. This increase, with a value of about 4s. 6d. with wheat at 3s. per bushel, cost 6s. with manganese sulphate at £24 per ton.

It is proposed that the response on this soil is due to an actual lack of manganese, particularly in patches, rather than to the unavailibility of the manganese present in the soil as it is correlated with a very low content of manganese soluble in concentrated hydrochloric acid, and a replaceable manganese fraction which is but little affected by water-logging.

From these experiments it may be concluded that it is unlikely that manganese fertilisers will materially increase crop yields on the major types of agricultural soils of the wheat belt and clover belt of Western Australia.* After some considerable period of cropping certain of the lateritic soil types may show some response to manganese fertilisers owing to extreme poverty with respect to this element.

ACKNOWLEDGMENTS.

The thanks of the authors are due to farmers and officers of various Government Departments who have assisted in the carrying out of the experiments described. Special indebtedness is due to Mr. G. K. Baron-Hay, the Superintendent of Dairying, and his staff for the handling of the experiments in the clover belt.

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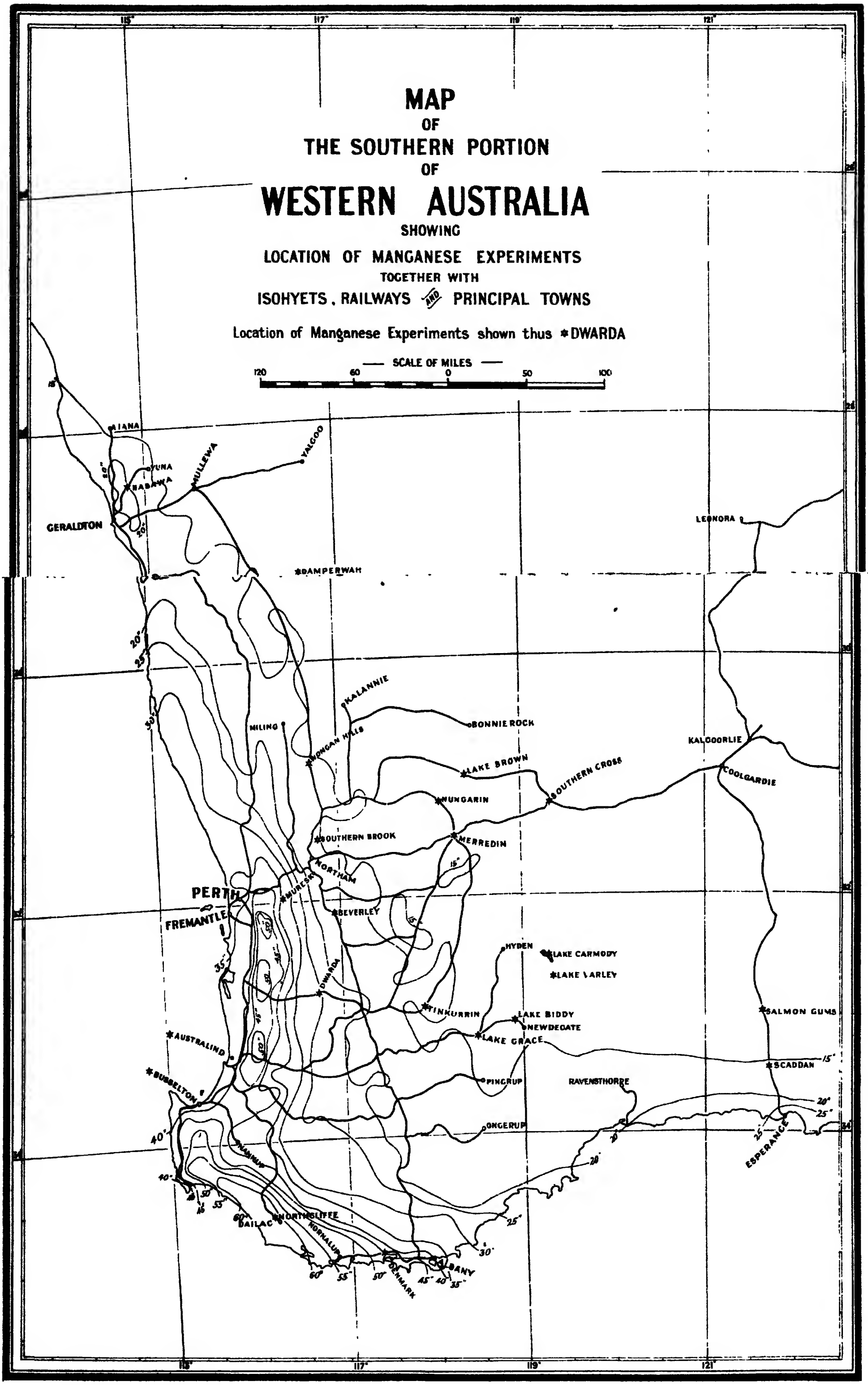
MAP
OF
THE SOUTHERN PORTION
OF
WESTERN AUSTRALIA
SHOWING
LOCATION OF MANGANESE EXPERIMENTS
TOGETHER WITH
ISOHYETS, RAILWAYS AND PRINCIPAL TOWNS
Location of Manganese Experiments shown thus *DWARDA
SCALE OF MILES
120 60 0 50 100
115° 117° 119° 121°
GERALDTON
MULLEWA
YALGOO
YUNA
DAMPERWAH
LEONORA
KALANNIE
MILING
WONGAN HILLS
BONNIE ROCK
LAKE BROWN
SOUTHERN CROSS
KALGOORLIE
COOLGARDIE
NUNGARIN
MERREDIN
SOUTHERN BROOK
NORTHAM
MURESK
PERTH
FREMANTLE
BEVERLEY
HYDEN
LAKE CARMODY
LAKE VARLEY
DWARDA
TINKURRIN
LAKE BIDDY
NEWDEGATE
LAKE GRACE
SALMON GUMS
SCADDAN
AUSTRALIND
BUSSELTON
PINGRUP
RAVENSTHORPE
ONGERUP
ESPERANCE
MANJIMUP
NORTHCLIFFE
DAILAC
NORNALUP
DENMARK
ALBANY
118° 117° 119° 121°

THE COST OF FEEDING PURE-BRED COWS UNDER THE OFFICIAL HERD RECORDING SCHEME, WESTERN AUSTRALIA, 1932-33.

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and

L. C. SNOOK, B.Sc. (Agric.), Agricultural Adviser.

During the present period of low prices, dairy farmers are much concerned with the costs entailed in producing milk and butter fat. For this reason the estimated cost of feeding pure-bred cows under official test during the past year should prove of particular interest. For a number of years tables have been published annually showing the productivity of the average tested cow, and the cost of the feed utilised to obtain this production. In Table 1. the yearly averages are listed, and some interesting comparisons may be made.

TABLE 1.—PURE-BRED COWS UNDER OFFICIAL TEST.

Average Results for last Ten Years.

Year ending 30th June:	Average Milk Yield per Cow.	Average Butter Fat per Cow.	Average Cost of Feed per Cow.	Average Feed Cost to Produce 1 lb. of Butter Fat.	Average Feed Cost to Produce 1 Gallon Milk.	Average Value of Butter Fat per lb.
	gals.	lbs.	£ s. d.	pence.	pence.	pence.
1924	600	319·50	10 4 10	7·7	4·09	19·5
1925	652	308·59	14 13 2	10·77	6·15	17·5
1926	624	312 01	14 14 7	11·15	5·66	19·0
1927	602	290 72	14 10 5	12·00	5·79	19 0
1928	592	280 56	15 11 4	13·34	6·34	19·5
1929	629	295·10	15 1 0	12·24	5·74	20·0
1930	636	294·98	14 10 3	12·74	5·10	19·5
1931	643	301·6	9 14 7	7·74	3·64	16·0
1932	696	318·96	10 18 3	8·21	3·76	14·0
1933	664	308·6	9 2 3	7·08	3·29	11·0

It will be noticed that the average production is not quite so high as it was in 1931-32. This, however, does not signify retrogression as the fall of production is in part the result of the somewhat unfavourable season and also to the entry of new herds which have not such a high average production as those herds which have been tested for a number of years.

Of more significance is the fact that the cost of feed per cow per annum for 1932-33 is the lowest yet recorded, being £1 16s. cheaper than that of last year and almost £6 below the cost for 1928-29. Unfortunately the value of butter fat has shown a corresponding decrease, the average price for 1932-33 being only a little over half that received in 1928-29. Even so, a study of the tables given hereafter will show that many herds are still producing at a profit. It is only too apparent, however, that other herds cannot be doing this, as the cost of feed alone absorbs nearly all the income from sale. This illustrates how fundamental is the need for economic feeding methods.

That improved methods are being used is shown by the lowered average feed cost this year—the saving of £1 16s. per cow has been made despite a slight increase in the average cost of the foodstuffs commonly purchased by dairymen. This indicates an increased use of good pasture, meadow hay, silage and home-grown concentrates. In two herds the food to produce one pound of butter fat costs approximately 4d., while in two other herds the food to produce the same product costs over 11d. This great difference explains why the method of feeding is one of the chief factors in determining whether or not a dairyman is successful financially.

Of the 21 herds under review, herds "F" and "M" (see Table IV.) stand out as producers at a low cost. Both are of the Jersey breed and belong to Mr. P. Rose, Burekup, and Mr. G. F. Combs, Jardee, respectively. In both herds milk was produced at a food cost of less than 2d. per gallon.

The herd of Mr. P. Rose is one of the largest under official test, and good mixed pasture constitutes the main food supply. Very little concentrate (crushed wheat) is fed in the bails, and the high average yield of 348 lb. butter fat testifies to the value of good grazing. No green summer pasture is available, so—except for early maize dependence is placed on meadow hay and silage for the summer months. This independence from purchased foodstuffs enables butter fat to be produced very cheaply. However, it is possible that the more lavish use of concentrates in this herd may have proved profitable, especially in prolonging the period of lactation.

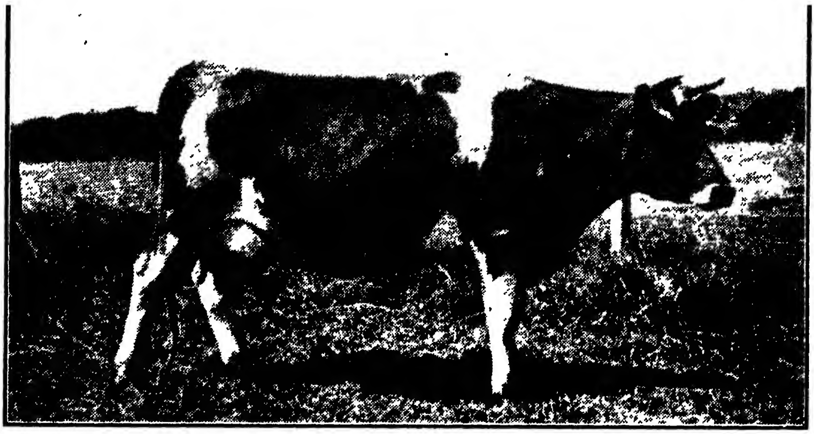
Banyule Silvermine 55th (25473).
Owned by Sabina Vale Stud Farm, Wonnerup.
Highest producing cow in the Junior Three-year-old Class, standard 270 lbs. butter fat. Produced 7,726 lbs. milk, average test 5·65%, 435·66 lbs. butter fat.

Herd "M," owned by Mr. Combs, is maintained at the very low annual cost of £5 per head. The system of management appears similar to that of Mr. Rose. Very little purchased material is used, and large quantities of silage are conserved. As the test cows in this herd milked all through the summer, the average production of 294 lb. butter fat was quite good. Here, again, one cannot help but wonder whether or not increased use of concentrates would have been profitable. These cows could hardly have been producing to a maximum on bulky roughages.

Farmers tend to overlook the fact that 3½d. worth of concentrates (say 5 lb. of bran) contain sufficient nutrients to produce a gallon of milk worth at least 6d. (if 5% test). In other words, 20s. spent on bran or its equivalent, and used by the cow for production, would furnish sufficient nutrients to produce 32s. worth of butter fat at 11d. per lb. In this case the outlay would be very profitable. Of course, this would apply only where the cows already were

receiving ample cheap roughage in the paddock, and one must assume that the cows had the inherent ability to utilise the extra food supplied. Concentrates are often wasted because they are merely used by the cow to save it from foraging in the field. Good food stimulates a good cow, while it only encourages a natural low producer to loaf.

The third lowest cost of producing butter fat was recorded by Mr. S. P. Herbert at Nungarin. This is quite a creditable performance, as wheat belt herds generally have high feeding costs. Mr. Herbert's cows were probably more profitable than the figures indicate, as it is doubtful if the foodstuffs used (all home grown) were worth to him the value given them in working out the costs (see Table III.). It is interesting to note that in Mr. Herbert's initial year, the food bill was nearly £11 per cow per annum. This year it is over £3 less, an important saving.



Karridale Queen (2754).
Owned by G. E. Scott, "Brookfields," Yarloop.
Produced 9,360 lbs. milk, average test 5.3%, 493 95 lbs. butter fat.
As a Senior Three-year old standard 290 lbs. butter fat.

Herd "B," owned by Mr. W. G. Burges, is, with Mr. P. Rose's herd, the largest under the Official Recording Scheme. It will be noticed that for this herd the profit per cow from the sale of butter fat was £10 14s. 4d., or fourth highest for the year. This is a good achievement in view of the fact that this stud is situated in a dry district and that the cows were maintained in milk throughout the whole year, not all freshening during the autumn so as to have the flush of the season during their high milking period. Of necessity the cost of feeding a herd under these conditions is higher than in areas where green feed and pasture are available over a long period, but the actual cost—£10 2s. 3d. per cow—is only 20s. per cow more than the average cost. Such returns, of course, have only been made possible through the high average production of the cows being fed, namely, 378 lb. butter fat per cow.

In Table II. the three breeds under test have been compared as regards productivity and cost of feeding. The Australian Illawarra Shorthorn cows show up particularly well from the point of view of production—it certainly seems as if the numerous importations of recent years from the Eastern States have proved very beneficial to the breed and the State. In past years the Jersey and Guernsey cows have proved very close rivals, but this year the Jersey owners have proved markedly successful in reducing feeding costs. This table shows the Jerseys to be

very economical producers of both milk and butter fat. It is only fair to state that the Guernseys as a breed were handicapped this year by the costly feeding methods of two herds. The Denmark State Farm Guernsey cows, on the other hand, were fed at the low annual cost of £7 19s. per cow.

TABLE 2.—BREEDS COMPARED AS PRODUCERS OF MILK AND BUTTERFAT.

Breed	Average Yield of Butter Fat per Cow	Average Test.	Average Yield of Milk per Cow.	Average Cost of Feed per Cow.	Cost of Food to Produce 1 gall. of Milk.	Cost of Food to Produce 1 lb. of Butter Fat.
	lbs	per cent.	lbs.	£ s. d.		
Jersey (10 herds)	296.8	5.1	5,870	7 8 3	3·03	5·99
Guernsey (5 herds) ..	296.1	5·0	5,876	10 8 10	4·26	8·46
A.I. Shorthorn (6 herds)	332·2	4·1	8,072	10 10 2	3·12	7·61

The following is a series of tables showing:—

TABLE 3.—PRICES USED IN VALUATING THE FOODSTUFFS CONSUMED DURING YEAR ENDING JULY, 1933.

Chaff—Oaten or Wheaten ...	...	£4 5s. 0d. per ton
Clover Hay ...	...	£3 0s. 0d. per ton
Silage ...	...	7/– per ton
Wheat (crushed)	...	3/– per bushel
Oats (crushed)	...	1/11d. per bushel
Bran ...	...	£5 12s. 6. per short ton
Pollard	...	£5 17s. 6d. per short ton
Linseed Meal	...	£12 10s. 0d. per short ton
Green Lucerne	...	£1 0s. 0d. per ton
Green Maize, Sudan Grass, Cereal Crops	Chaffed ...	6/– per ton
Green Maize, Sudan Grass, Cereal Crops	Grazed ...	2/6 per head per week
Pasture ...	...	1/6 per head per week

"Victress of Toora," owned by W. G. Burges, "Tipperary," York.
Highest Producing Cow in the Junior Four-year-old Class. Standard, 310 lbs. butter fat. Production, 10,074 lbs. milk; Average test, 4.7 per cent.; 475.48 lbs. butter fat.

TABLE 4.—HERDS IN ORDER OF MERIT AS PRODUCERS OF BUTTER FAT.

Herd.	Breed.	Average Production of Butter Fat per Cow for 9 months.	Average Production of Skim Milk per Cow for 9 months.	Value of Butter Fat at 11d. per lb.	Value of Skim Milk at 11d per gallon.	Gross Return from Fat and Skim Milk.	Cost of Feed per Cow for 12 months.	Profit per Cow by Sale of Butter Fat	Cost of Feed to produce 1lb. of Butter Fat.
		lbs.	lbs.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	pence.
A	Guernsey	413·0	7,014	18 18 7	2 18 5	21 17 0	9 17 6	11 19 6	5·74
B	A.I.S.	377·9	8,420	17 6 5	3 10 2	20 16 7	10 2 3	10 14 4	6·42
C	Jersey	374·2	6,367	17 3 0	2 13 0	19 16 0	10 15 0	9 1 0	6·90
D	Guernsey	365·0	5,951	16 14 7	2 9 7	19 4 2	12 9 7	6 14 7	8·20
E	A.I.S.	361·4	7,301	16 11 3	3 0 10	19 12 1	16 18 3	2 13 10	11·23
F	Jersey	348·1	6,148	15 19 1	2 11 3	18 10 4	5 13 6	12 16 10	3·91
G	do.	336·2	5,787	15 18 2	2 8 3	17 16 5	7 17 9	9 18 8	5·63
H	A.I.S.	315·6	6,377	14 9 4	2 13 3	17 2 7	7 19 8	9 2 11	6·08
I	do.	307·2	6,933	14 1 7	2 17 9	16 19 4	10 9 10	6 9 6	8·20
J	do.	306·5	6,789	14 1 0	2 16 7	16 17 7	10 11 10	6 5 9	8·30
K	Jersey	302·2	5,276	13 17 0	2 4 0	16 1 0	9 6 0	6 15 0	7·38
L	A.I.S.	298·7	6,790	13 13 10	2 17 9	16 11 7	8 7 0	8 4 7	6·71
M	Jersey	293·8	5,440	13 9 4	2 5 4	15 14 8	5 0 0	10 14 8	4·08
N	do.	292·0	4,746	13 7 8	1 19 7	15 7 3	9 10 0	5 17 3	7·81
O	Guernsey	286·7	5,383	13 2 10	2 4 10	15 7 8	7 19 0	7 8 8	6·65
P	Jersey	286·4	5,350	13 2 6	2 4 7	15 7 1	7 0 7	8 6 6	5·87
Q	Guernsey	284·3	5,046	13 0 7	2 2 1	15 2 8	11 1 4	4 1 4	9·33
R	Jersey	261·5	4,460	11 19 8	1 17 2	13 16 10	9 11 1	4 5 9	8·77
S	Guernsey	248·4	4,492	11 7 8	1 17 5	13 5 1	11 16 10	1 8 3	11·45
T	Jersey	246·5	4,385	11 6 0	1 16 7	13 2 7	6 16 6	6 6 1	6·65
U	do.	241·3	4,559	11 1 2	1 18 0	12 19 2	7 16 2	5 3 0	7·76
Average ...	... ...	308·6	5,979	11 2 10	2 9 10	16 12 8	9 2 3	7 10 5	7·08

TABLE 5.—HERDS IN ORDER OF MERIT AS PRODUCERS OF MILK.

Herd.	Breed.	Average Yield of Milk per Cow for 9 months.	Value of Whole Milk at 9d. per Gallon.	Cost of Food per Cow for 12 Months.	Profit over Cost of Food.	Cost of Food to Produce 1 gallon of Milk.
		lbs.	£ s. d.	£ s. d.	£ s. d.	pence
B	A.I.S.	9,356	35 2 0	10 2 3	24 19 9	2·59
E	do.	8,112	30 8 3	16 18 3	13 10 0	5·00
A	Guernsey	7,749	29 1 3	9 17 6	19 3 9	3·06
I	A.I.S.	7,703	28 17 6	10 9 10	18 7 8	3·27
L	do.	7,544	28 5 6	8 7 0	19 18 6	2·66
J	do.	7,533	28 5 6	10 11 10	17 13 8	3·37
H	do.	7,086	26 11 6	7 19 8	18 11 10	2·74
C	Jersey	7,074	26 10 3	10 15 0	15 15 3	3·65
F	do	6,831	25 12 3	5 13 6	19 18 9	1·99
D	Guernsey	6,723	25 4 0	12 9 7	12 14 5	4·45
G	Jersey	6,430	24 2 3	7 17 9	16 4 6	2·94
M	do	6,045	22 13 9	5 0 0	17 13 9	1·99
O	Guernsey	5,981	22 8 6	7 19 0	14 9 6	3·19
P	Jersey	5,945	22 6 3	7 0 7	15 5 8	2·83
K	do.	5,862	21 19 6	9 6 0	12 13 6	3·81
Q	Guernsey	5,607	21 0 9	11 1 4	9 19 5	4·73
N	Jersey	5,273	19 15 3	9 10 0	10 5 3	4·32
U	do.	5,066	19 0 3	7 16 2	11 4 1	3·70
S	Guernsey	4,991	18 4 3	11 16 10	6 17 5	5·70
R	Jersey	4,956	18 12 0	9 11 1	9 0 11	4·62
T	do	4,872	18 5 3	6 16 6	11 8 9	3·36
Average	...	6,643	24 18 3	9 2 3	15 16 0	3·29

TABLE 6.—SUMMARY OF RESULTS, 1932–33.

The average pure-bred cow under official test produced in nine months:—

1. 6,643 lbs. of Milk.
2. 308·6 lbs. of Butter Fat.

	£ s. d.
Value of Butter Fat at 11d. lb.	14 2 10
Value of Skim Milk at 1d. gallon	2 9 10
Total Return	16 12 8
Cost of Food for 12 months	9 2 3
Net Return from Sale of Butter Fat ...	£7 10 5
Value of Whole Milk at 9d. gallon	24 18 3
Cost of Feed	9 2 3
Net Return by Sale of Whole Milk ...	£15 16 0

Cost of Feed to Produce 1 gallon of Milk = 3·29 pence.

Cost of Feed to Produce 1 lb. of Butter Fat = 7·08 pence.

THRIPS IMAGINIS (BAGNALL).

By

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and

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The Apple Thrips, as this species is usually termed, is at present the most important insect pest with which the growers of deciduous fruits in this State have to contend.

On account of the minute size of the insect, the rapidity of its spread over large areas and the suddenness of attack in great numbers, completely blasting in a few days all prospects for a crop of fruit, the control of this pest is a matter of considerable difficulty. There is no reason to believe, as some have stated, that the insect will disappear in a few years, but is should be regarded as a permanent pest.

The injury is caused by the feeding of the adults on the developing flower buds. The act of depositing the eggs into the flowers also causes further damage. The feeding injury is not produced by a biting or chewing process. By rasping the flowers with their hardened or chitinous mouth parts, the thrips cause an exudation of sap, which they readily suck up.

Thrips imaginis is a native of Australia, and was first described by R. S. Bagnall in 1926. This pest is perennial in its occurrence, being found in its various stages throughout the year. The most damaging swarms make their appearance during the spring and early summer, minor swarms appearing sometimes in the autumn.

This thrip has many host plants, including native, garden, and orchard flowers.

The adult thrips are light to darkish brown in colour and measure slightly less than one-twenty-fifth of an inch in length. They possess two pairs of narrow and extremely delicate wings, fringed with long hairs, and when not in flight they lie along its back. The eggs, which are very minute, are inserted in various parts of the flower by means of the saw-like ovipositor of the female.

The young resemble the adults in general appearance, except that they have no wings, are smaller in size and lighter in colour.

During the past season the loss of fruit by this pest was only slight. This escape was due entirely to natural causes and not to the application of any preventive or remedial measures.

In an endeavour to obtain further information concerning the factors which govern the appearance of this thrip in plague form, a project was prepared. Last year, 1932, the first section of this work was undertaken.

This included the following:—

1. The taking of a thrip census.
2. The recording of the meteorological conditions.
3. The taking of soil temperatures.

These three initial investigations would determine the numbers and species of thrips present in the flowers. The numbers then to be correlated with the prevailing meteorological conditions and the temperature of the soil.

Mt. Barker was selected as the centre for this work.

As a comparative test, in the more northern fruit-growing areas a bi-weekly census was taken at Mundaring. For general information including all fruit districts, arrangements were made with the Superintendent of Horticulture, for his officers to forward at regular intervals thrip-infested material. This included orchard, garden, and native flowers. The collecting of flowers was commenced in February and continued until the end of the following November. The species of thrips present were separated, identified, and their relative numbers noted.

The observations at Mt. Barker were commenced on June 26th, 1932. During June to September 22nd, bi-weekly visits were made. The material collected was brought back to the laboratory, counted, and identified.

On the 22nd September it was decided that Mr. Andrewartha should be stationed at Mt. Barker, this work being continued until the 7th November. This gave opportunity for the taking of a daily census of the thrips, also records of the soil temperature and rainfall, during the critical flowering period of the apple trees.

The outcome of the general and specific collecting proved that the plague thrips (*Thrips imaginis*) occurred in moderate numbers from February to September.

On 19th and 20th October, a sudden burst of hot weather came in (shade temperature 87 deg. F.). This affected all areas from Bridgetown northwards, *Thrips imaginis* appearing in plague form. At this time, as shown by the records taken in the more southern area of Mt. Barker, the temperatures did not rise to the same degree, hence the pest did not swarm.

This was undoubtedly the peak period for 1932 in the Bridgetown, West coastal, and Darling Range country. The average number of *Thrips imaginis* per fruit tree blossom at this period at Mundaring was 24, rising as high as 50 in the Roleystone area and were reported to be swarming in the Bridgetown orchards. The swarm had, however, appeared too late to injure seriously the main setting of fruit. The pest then concentrated on belated blooms and late flowering varieties, causing considerable damage to them. Had the awarm appeared two or three weeks earlier, there is little doubt, judging from the damage done to late apple blossom and roses, that we should have had to record a very serious failure of the apple crop.

A feature observed in the Bridgetown district was the swarming of pre-winged thrips in the belated blossoms, and the partly-closed calyx of the formed fruit.

It was also noted, that blossoms that were well out, when the plague of thrips struck them, set fruit, but blossoms in the pinking stage were totally destroyed.

The numbers of *Thrips imaginis*, in the Mundaring district, had fallen from 24 per blossom on the 20th October to 12 on the 3rd November.

In the Mt. Barker area and southward, the pest did not at any time reach dangerous proportions. The maximum number of thrips per blossom, recorded at Mt. Barker, was 14. This peak period occurred on the 30th October, 10 days later than the plague swarm in the more northern areas.

The relationship of thrip abundance and the flowering of eucalypts was carefully observed.

The year 1932 was a light gum blossom one. The red gum and jarrah, two species suspected of having an important bearing on the breeding up of the thrip population. blossomed very sparsely.

There was no flowering of the jarrah in July, August, September, as occurred in the thrip plague year, 1930. In spite of the lack of gum blossom, a plague swarm of thrips did occur, but, as before mentioned, owing to unfavourable climatic conditions, it appeared too late to effect seriously the main apple blossoming.

This certainly appears to discredit any theory, that the presence or otherwise of *Thrips imaginis*, depends upon the flowering of eucalypts.

The work done at the Mt. Barker and all other districts, from which material was collected and forwarded, gave definite evidence that the chief host plants during June to September were the various species of native and introduced acacias.

The State is very prolific in native acacias, which grow on the country adjacent to our orchard lands. The acacias, unlike the eucalypts, flower profusely every year and thus prove to be a regular carry-over of the thrips, rather than the irregular flowering eucalypts. Besides acacias, this thrips was found breeding and infesting some 15 other native species of flowers, also numerous garden flowers.

The common Cape-weed (*Cryptostemma calendulaceum*) was not at any time found to be heavily infested.

The more specific investigation was carried out at Mt. Barker by Mr. H. G. Andrewartha.

The work was solely concerned with the conduction of a census with the view of correlating thrips numbers with meteorological conditions. From 26th June to 22nd September, samples were taken at approximately fortnightly intervals at Mt. Barker; and from 22nd September to 7th November the samples were taken daily. During the latter period 1in. maximum soil temperatures were also recorded.

During the first period collecting was confined to bush flowers. The following list of plants were examined to obtain the thrips which figure in Table 1. An asterisk indicates that no *Thrips imaginis* were obtained.

Hovea chorizemifolia*
Grevillea Brownii*
Leucopogon verticillata*
Eucalyptus calophylla
Acacia podalyriæfolia
Acacia cyanophylla
Acacia Drummondii
Acacia decurrens
Acacia myrtifolia
Acacia extensa
Acacia pulchella
Daviesia sp.*
Raphanus raphanistrum
Cryptostemma calendulaceum
Hypocalymma angustifolium
Bossiæa linophylla*
Hardenbergia Comptoniana*

TABLE 1.—THRIPS FROM BUSH FLOWERS.

Date.	Thrips Imaginis. Females Pale.	Thrips Imaginis. Females Dark.	Thrips Imaginis. Males.	Thrips Imaginis. Larvae.	Other Species.	Total.
27-6 32	.	.	..	..	14	14
18 7-32	9	...	2	34	21	66
1 -8-32	49	61	32	...	75	217
18-8-32	38	164	105	..	152	459
20 8-32	45	34	4	3	120	206

At first an attempt was made to form an estimate of the number of thrips per flower on each of the dates occurring in the table, but this proved to be impracticable for the following reasons:—

(a) Most of the species examined only flowered over a limited period and did not last for the full two months of the investigation; further, the individual plants within the species flowered for an even shorter time.

(b) It was found to be very difficult to select flowers of a uniform "freshness", and the age of the flowers (particularly in certain acacias) was found to have a marked effect on the number of thrips they contained; *e.g.*, of two samples of *Acacia podalyriaefolia* taken from the same tree, one consisting of 72 flower heads, contained 265 *Thrips imaginis;* the other, consisting of 120 flower heads, contained no thrips.

Because of this difficulty in obtaining uniform conditions for sampling, the idea of obtaining a quantitative estimate of the thrips population of the bush-flowers during these months was abandoned. Instead, a random sample of thrips was collected from as wide a variety of hosts as possible and arranged into pale and dark females, males and numphs, as shown in Table 1.

From this table several facts emerge:—

(a) *Thrips imaginis* breeds throughout the year—75 per cent. of the samples collected 18/7/32 were nymphs.

(b) The life cycle at this period of the year is fairly protracted. After the sample taken on 18/7/32, the samples for the next month contained no nymphs, and even on 29/8/32 the nymphs only represented 3.5 per cent. of the total samples.

(c) Parthenogenisis is apparently not a feature of reproduction during the winter—all the samples contained some males and that taken on 18/8/32 contained 34.2 per cent. males.

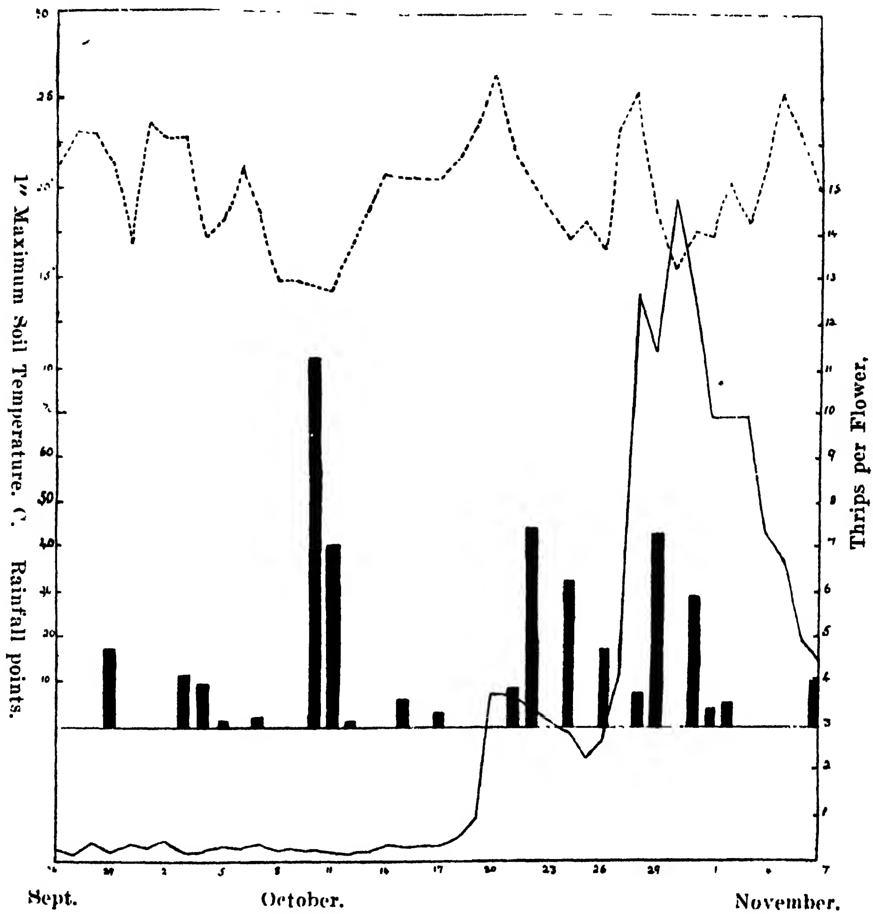
From 26/9/32 daily samples were collected from apple-flowers. The samples were taken from the same three orchards each day. In Table 2 the thrips have been grouped into pale and dark females, males and nymphs, and the one-inch soil temperatures, the maximum shade temperatures, and the rainfall have been added.

TABLE 2.

Date	Females		Thrip Imaginis.				No. of Flowers.	1" Soil Max. C	Shade Max. C.	Rain Points.
	Pale.	Dark	Males	Nymphs	Total.	Thrips per Flower.				
1932										
September 26	3	2		..	5	0·25	20	21·2	17·2	...
27	5	..	..	...	5	0·12	40	23·3	21·1	...
28	15	2		...	17	0·42	40	23 0	18·8	...
29	11	2		...	13	0·21	60	21·2	17·7	17
30	19	5	..	..	24	0·40	60	16·9	13·9	...
October 1	13	4	1	..	18	0·30	60	23·6	19·4	...
2	13	6	.	..	19	0·47	40	22·7	..	...
3	14	2	.	...	16	0 20	80	22·7	18·3	12
4	13	6	.	..	19	0·24	80	17·2	13·3	10
5	29	5		...	34	0·34	100	18·6	17 7	1
6	18	9		..	27	0·27	100	21·3	16·1	...
7	29	8	1	3	41	0 41	100	18·6	14·4	2
8	27	5		1	33	0·33	100	14·7	11 7	...
9	...	..	.	..	..	...	..	14·7	..	...
10	..	.		.	.	..		..	12 2	82
11	12	6	..	6	24	0·24	100	14 2	12 2	40
12	15	3		3	21	0·18	120	16·6	14·4	1
13	18	6	...	2	26	0·26	100	18·9	16·1	...
14	22	11	6	6	45	0·45	100	20·8	20·0	...
15	17	13	1	1	32	0·32	100	20·5	19·4	9
16	...	...	.	..	...	...	...	...	...	...
17	17	20	1	6	44	0·38	120	20·5	17·7	5
18	10	6	10	12	38	0·32	120	21·6	20·5	...
19	42	40	23	14	119	0·99	120	23·5	22·8	...
20	260	48	53	12	373	3·73	100	26·6	26·6	...
21	244	50	56	19	369	3·07	120	22·2	20·0	...
22	..	...	...	..	...	...	...	...	...	...
23	...	..	...	...	..	...	...	...	...	10
24	238	47	41	12	338	2·82	120	17·2	17·7	45
25	37	6	3	...	46	2·30	20	18·3	17·2	...
26	205	27	31	2	265	2·65	100	16·4	15·5	17
27	299	59	59	2	426	4·26	100	23·8	18·3	...
28	851	64	63	...	978	12·22	80	25·5	25·5	7
29	196	13	18	...	227	11·48	20	18·9	16·1	40
30	517	37	40	...	594	14·85	40	15·5	...	...
31	870	76	52	...	998	12·47	80	17·0	13·3	29
November	685	61	47	..	793	9·91	80	17·2	22·2	4
2	..	...	...	...	...	...	...	20·5	18·3	5
3	528	37	32	...	597	9·95	60	18·3	15·5	...
4	377	39	22	4	442	7·36	60	21·2	18·3	...
5	302	86	52	3	393	6·66	60	25·5	23·9	...
6	146	14	35	1	196	4·90	40	23·9	...	...
7	142	12	23	3	180	4·50	40	19·4	17·2	9

Fig. 1.

This figure is based upon the data given in Table II. The continuous line represents the number of Thrips imaginis per flower. The broken line maximum 1" soil temperatures, the black lines the rainfall.



Thrips Census, Mt. Barker, 1932.

The one-inch soil temperature followed the shade temperatures fairly closely, but remained consistently 2 deg. to 3 deg. higher.

The temperatures during October were consistently low. Only twice did the shade temperature reach 25 deg. C. (77 deg. F.), and on each occasion the hot spell lasted for only two days. The mean daily temperature for the month was 55.5 deg. F. (13.0 deg. C.).

The total rainfall for the month of October was 329 points, spread over 15 days. The average October rainfall for 39 years is 296 points.

A further idea of the weather conditions can be formed from the weather bureau's classification of cloud conditions into "fine", "cloudy" and "overcast". Of the 26 records made (Sunday conditions are not recorded), there were 13 days overcast, 3 days cloudy, and 10 days fine.

The number of thrips remained fairly constant at about 0.3 per blossom from 26/9/32 until 18/10/32. This does not mean that the actual numbers of thirps remained so steady, since the amount of apple blossom in the orchards was steadily increasing during this period. But it does mean that the increases in the thrips was a very steady and gradual one. Then on the 20th, following a soil temperature of 26.6 deg. C. (80 deg. F.), the numbers jumped up to 3.7 per blossom. This represented an increase of about 350 per cent. in one day or nearly 900 per cent. in two days. There followed a spell of cool cloudy, rainy weather, during which the thrips remained constant at about 3 to a blossom. Following a soil temperature of 25.5 deg. C. (78 deg. F.) on the 27th, the numbers jumped up to 12.2 per blossom on the 28th. This represented an increase of 200 per cent. in one day or nearly 500 per cent. in two days. The temperature on the 29th dropped to 18.9 deg. C. and the weather remained cool and cloudy until 7/11/32, when the census was concluded. During this period, following the peak, on the 28th, the numbers declined steadily from 12 to 4.5 per blossom on 7/11/32.

Although these figures are dealing only with comparatively small numbers of thrips (too few to constitute a menace), they serve to indicate very clearly the effect of a sudden hot spell upon the numbers of thrips in the blossoms. They show why, in a plague year, the swarms appear with such devastating suddenness.

The relative scarcity of *Thrips imaginis* in Mt. Barker this year might possibly have been the outcome of any or all of the following factors:—

(a) The winter "carry-over" may have been too slender to provide a swarm.

(b) The weather conditions during September and October may not have been suitable.

(c) There may have been a scarcity of food in the bush during September and early October.

That either (a) or (c) were of any importance would seem to be negatived by observations taken at Bridgetown on 6/9/32, as set out in Table 3.

TABLE 3

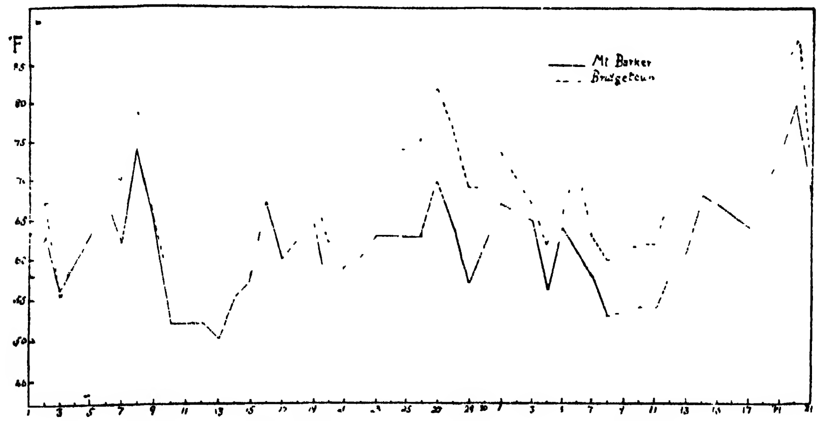
—	Acacia pulchella (3,000 heads)	Acacia cyanophylla (1,000 heads).	Eucalyptus cladocalyx (20 flowers).	Tota .
Thrips tabaci	1	1	...	2
Odontothrips australis	2	...	...	2
Isoneurothrips australis	5	3	16	24
Physothrips sp.	81	1	...	82
Thrips imaginis	.	...	...	...
Total	89	5	16	110

Altogether 3,000 heads of *Acacia pulchella*, 1,000 heads of *Acacia cyanophylla*, and 20 flowers of *Eucalyptus cladocalyx* were examined, but did not yield a single *Thrips imaginis*.

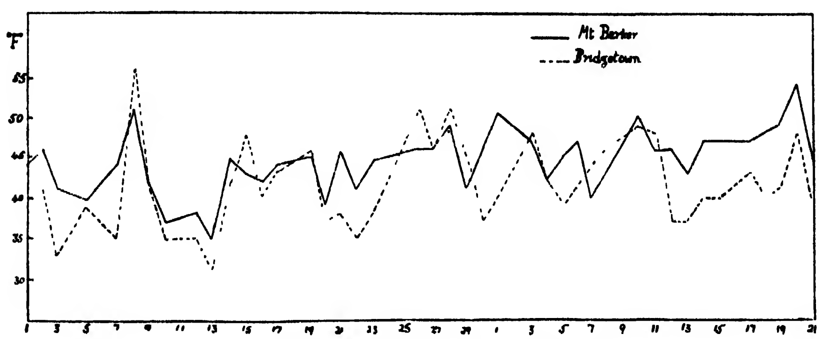
When these figures are compared with those set out in Table IV., which shows the results of collecting done in Mt. Barker on 29/8/32, it is immediately apparent that the winter "carry-over" was more slender in Bridgetown than in Mt. Barker —and yet, on 19/10/32 thrips swarmed in Bridgetown, whereas in Mt. Barker they never reached plague numbers.

Daily **Maximum Shade** Temperatures.

Fig. II.



Note that the Bridgetown temperatures were consistently higher during the whole period from September 1st to October 21st. Compare this with Fig. III.



Daily Minimum Shade Temperatures.

Fig. 3.—Note that the Bridgetown minimum temperatures are mostly lower than those for Mt. Barker. This is associated with the bright days and consistently higher maxima recorded at Bridgetown. (See Fig. 2.)
September. October.

TABLE 4.

——	Acacia pulchella (500 heads).	Acacia cyanophylla (2,000 heads).	Acacia extensa (1,000 heads).	Total.
Physothrips sp.	3	1	8	12
Isoneurothrips australis	...	30	...	30
Odontothrips australis	...	2	...	2
Thrips imaginis	...	13	27	50

It would therefore seem that of the three factors enunciated above, (b) must be the important one.

Just how the weather conditions operated to prevent swarming of thrips is not too plain. Apparently there were two factors operating:—

(a) The low temperatures slowed down development very greatly.

(b) There are indications that there was a fairly high mortality during October.

The conclusion that there was a high mortality during October depends upon the assumption that females of *Thrip imaginis* change from a pale yellow to a dark brown within a few days of emerging from the soil. In Table 5, the ratio of dark to pale females collected during October is set out.

The interesting thing about these figures is the persistently low ratio of dark to pale females. The only occasion when it rises above unity is on 17/10/32. For the rest of the time it is considerably below unity. Taken in conjunction with the comparative steadiness of the figures for total thrips population, this ratio must indicate a considerable mortality of newly emerged adult females (if the above assumption holds good).

The very pronounced scarcity of nymphs, particularly after about 25/10/32, would also bear this out, as there are only two possible explanations for it. Either the adults were dying before laying many eggs, or else there was a high mortality among the nymphs. Probably both factors were operating.

TABLE 5.—RATIO OF DARK TO PALE FEMALES.

Date.	Ratio—Dark to Pale.	Date.	Ratio—Dark to Pale.	Date.	Ratio—Dark to Pale.
October 1	0·3	October 12 .	0·2	October 22 ..	...
2	0·4	13 ..	0·3	23 ...	..
3 .	0·1	14 ...	0·5	24 .	0·2
4 .	0·[illegible]	15 ..	0·8	25 .	0·2
5 ...	0·2	16 ..	...	26 ...	0·1
6 ...	0·5	17 ...	1·2	27 ...	0·2
7 ..	0·3	18 ...	0·6	28 ...	0·1
8 .	0·2	19 ..	0·9	29 ...	0·1
9 ..	.	20 ..	0·2	30 .	0·1
10 .	..	21 ..	0·2	31 ..	0·1
11 .	0·3				

Summarising the facts as set out above, we have the following conclusions:—

(a) *Thrips imaginis* breeds slowly throughout the winter months, its principal host flowers during this period being the many native flowering plants, with a distinct preference for plants of the genus acacia.

(b) It has been demonstrated that a swarm may occur, though the winter carry-over is exceedingly slender, as at Bridgetown last winter.

(c) Even though the winter carry over is comparatively large, meteorological conditions during September-October may prevent swarming, as in Mt. Barker last spring.

(d) The prevailing low temperatures (operating to increase the period of development and thus decrease the numbers of generations) were at least partially responsible for the absence of swarming at Mt. Barker.

(e) There is, however, some evidence that there was a high mortality amongst certain stages—particularly newly emerged females.

(f) This mortality (if it occurred) was probably the outcome of adverse meteorological conditions, but just what factors were responsible is not yet too plain.

(g) Given early favourable weather conditions, there are possibilties of a damaging plague of thrips any spring.

(h) The peak swarm on the 19th and 20th October, 1932, appeared too late to cause serious damage, except to belated or late-flowering varieties of apples.

(i) In the districts from Mt. Barker south, the pest did not at any period reach damaging numbers.

In the taking of the thrips census numerous species other than *Thrips imaginis* were identified and recorded.

Amongst those species found, the following were most numerous:—*Isoneurothrips australis*, numerous in the months of February, March, and June. Present in moderate numbers during the remaining months of the year. In June, July, and August, the dark form predominated.

Chief food plants, eucalyptus and other bush flowers, few in cultivated flowers.

Thrips tabaci, moderate numbers throughout the year.

Main host plants, cultivated flowers, vegetables and miscellaneous bush flowers.

Odontothrips australis, numerous March to May, moderate June to September. Host plants, acacias, hovea, and other native legumes. Few in cultivated flowers.

Frankliniella insularis, moderate October to January, numerous February, March, April, May, much reduced, June to September only slightly in evidence.

Host plants, garden flowers, and few in eucalyptus.

Microcephalothrips abdominalis, small numbers, February to May, garden flowers.

The complete list of *Thysanoptera* collected during the year is given hereunder.

RECORDS OF THYSANOPTERA.

Species.	Host Plant.	Locality.	Date.
Thrips imaginis (Bag.)	Eucalyptus spp	Belmont	29-2-32, 7-4-32
		Spearwood	2-3-32
		Baker's Hill	7-3-32
		Gosnells	12-3-32
		Harvey	14-3-32
	Acacia podalyriaefolia	Perth	16-5-32
		Bayswater	27-7-32
	Acacia baileyana	Caversham	27-7-32
		Bedfordale	25-8-32
	Acacia cyanophylla	Narrogin	17-8-32
		Mt Barker	29-8-32
		Mundaring	30-9-32
	Acacia microbotrya	Perth	26-8-32
	Acacia extensa	Mt. Barker	29-8-32
	Acacia alata	Kalamunda	16-9-32
	Acacia pulchella	Lesmurdie	22-9-32
		Mundaring	30-9-32
	Acacia oncinophylla	Lesmurdie	22-9-32
	Acacia saligna	Narrogin	3-10-32
	Acacia spp.	Mundaring	5-7-32
		Bedfordale	13-7-32
		Wooroloo	22-8-32, 21-9-32
		Wanneroo	23-8-32
		Jandakot	26-8-32
		Spearwood	30-8-32
	Eucalyptus calophylla	Mundaring	9-5-32
	Eucalyptus rudis	Wooroloo	22-8-32
		Kelmscott	15-10-32
	Hypocalymma angustifolia	Mundaring	30-9-32
	Agonis linearifolia	Kelmscott	15-10-32
	Hakea prostrata	Spearwood	21-10-32
	Dryandra floribunda	Spearwood	21-10-32
	Melaleuca radula	Lesmurdie	22-9-32
	Raphanus raphanistrum	Mundaring	5-7-32
	Rosa spp.	Bridgetown	29-2-32
		Bayswater	6-7-32
		Perth	26-8-32
	Nerium oleander	Bridgetown	29-2-32
	Dahlia spp.	Guildford	9-4-32
	Eriobotrya japonica (loquat)	Mundaring	30-5-32, 13-6-32
		Clontarf	4-6-32
	Citrus limonia	Mundaring	13-6-32

RECORDS OF THYSANOPTERA—*continued.*

Species	Host Plant.	Locality.	Date.
Thrips imaginis (Bag.) ...	Chrysanthemum coronarium (marguerite)	Maida vale	21-10-32
	Prunus persico (peach) ...	Mundaring	30-9-32
	Prunus avium (cherry) ...	Mundaring	30-9-32
	Pyrus communis (pear) ..	Mundaring	30-9-32, 19-10-32
	Prunus salicina (jap plum) ..	Mundaring	30-9-32
	Pyrus malus (apple)	Mundaring	19-10-32, 3-11-32
		Karragullen	1-11-32
		Kalgan River ..	28-10-32
	Miscellaneous garden flowers ...	Belmont	7-3-33
		Mundaring	9-5-32
		Perth	14-6-32
	Miscellaneous wild flowers ...	Maida Vale	17-6-32
		Denmark	6-7-32
		Narrogin .. .	26-8-32
		Harvey	24-8-32
		Mt. Barker	12-9-32, 19-9-32
		Mundaring	12-9-32
	Unspecified	Albany	7-7-32
Thrips tabaci (Lind.) ...	Rubus fruticosus	Bridgetown	29-2-32
	Acacia podalyriaefolia ..	Perth	16-5-32
	Acacia pulchella	Bridgetown	6-9-32
		Harvey	24-9-32
	Acacia cyanophylla	Bridgetown	6-9-32
	Acacia sp.	Spearwood ...	30-8-32
	Olearia paucidentata .. .	Kalamunda .. .	3-5-32
	Kennedya prostrata . ..	West Swan .. .	25-6-32, 24-9-32
	Raphanus raphanistrum .	Mundaring .. .	5-7-32
	Rosa spp.	Bridgetown	29-2-32
	Nerium oleander ...	Bridgetown . .	29-2-32
	Dahlia sp.	Guildford .. .	9-4-32
	Allium cepa (leaves)	Mundaring	5-7-32
	Ageratum sp . . .	Bayswater . .	6-8-32
	Lupinus sp. .	West Swan ..	24-9-32
	Chrysanthemum coronarium (Marguerite)	Maida Vale .	21-10-32
	Eucalyptus sp . ..	Harvey .	14-4-32
	Miscellaneous garden flowers .	Belmont . ..	7-3-32, 10-5-32
		Queen's Park ..	6-4-32
		Serpentine . ..	10-4-32
		Mundaring ..	9-5-32
		Perth . .	18-5-32, 14-6-32
		Bayswater . ..	4-6-32
		Denmark . .	6-7-32
		Narrogin ..	17-8-32
		Mt. Barker . ..	19-8-32
	Miscellaneous Bush flowers ...	Mundaring . .	13-5-32, 12-9-32
		Bedfordale . .	13-7-32
		Midland Junction ..	12-8-32
		Harvey . .	24-8-32
		Mt Barker	19-9-32
		Kalgan River ...	28-10-32
Isoneurothrips australis (Bag.)	Eucalyptus calophylla ...	Beton	11-5-32
		Mundaring .	9-5-32
		Belmont	19-5-32
		Bridgetown ..	20-5-32
	Eucalyptus rudis	Gosnells . ..	25-6-32
		Wooroloo . ..	22-8-32, 21-9-32
		Wanneroo	22-9-32
		Kelmscott . ..	15-10-32
	Eucalyptus cladocalyx ...	Bridgetown	6-9-32
	Eucalyptus spp.	Belmont	29-2-32, 7-3-32, 6-4-32, 7-4-32
		Baker's Hill	7-3-32
		Gosnells	12-3-32
		Harvey	14-3-32, 14-4-32
		Mundaring	30-5-32
		Bridgetown	15-6-32
		Denmark	6-7-32
		Wanneroo	23-8-32
	Acacia Baileyana	Caversham	27-7-32
		Bridgetown	19-8-32
	Acacia cyanophylla	Mt. Barker	29-8-32
		Bridgetown	6-9-32
	Acacia pulchella	Bridgetown	6-9-32
		Harvey	24-9-32
	Acacia spp.	Mundaring	5-7-32, 30-5-32
		Wanneroo	23-8-32
	Eriobotrya Japonica (loquat) ..	Mundaring	13-6-32
	Agonis linearifolia	Kelmscott	15-10-32
	Prunus avium (cherry) ...	Mundaring	30-9-32
	Pyrus communis (pear) ...	Mundaring	30-9-32
	Prunus salicina (Jap. plum) ...	Mundaring	30-9-32
	Rosa sp.	Bayswater	6-8-32
	Miscellaneous Bush flowers ...	Toodyay	11-4-32
		Bibra Lake	22-4-32

RECORDS OF THYSANOPTERA—*continued.*

Species of Thrip.	Host Plant.	Locality.	Date.
Isoneurothrips australis (Bag.)	Miscellaneous Bush flowers ...	Mundaring	30-5-32, 12-9-32
		Harvey	24-8-32
		Albany	6-9-32
		Mt. Barker	19-9-32
	Miscellaneous garden flowers ...	Belmont	7-3-32
		Mundaring	9-5-32
		Denmark	6-7-32
Odontothripella australis (Bag.)	Acacia podalyriaefolia	Perth	16-5-32
	Acacia cyanophylla	Mt. Barker	29-8-32
	Acacia Baileyana	Bedfordale	25-8-32
	Acacia pulchella...	Bridgetown	6-9-32
	Hovea trisperma	Maida Vale	17-6-32
	Hoveaspp.	Mundaring	30-5-32
		Bedfordale	13-7-32
	Kenneyda prostrata	West Swan	25-6-32, 24-9-32
	Davlesia pectinata	Cannington	24-6-32
	Hardenbergia	West Swan	29-7-32
	Comptoniana	Guildford	10-9-32
	Oxylobium capitatum	West Swan	13-8-32
	Oxylobium cuneatum ...	Mundaring	19-10-32
	Banksia Menziesii	Gnangara	16-6-32
	Raphanus raphanistrum	Mundaring	5 7-32
	Miscellaneous Wild flowers	Mundaring	30-5-32
		Maida Vale	8-8-32
	Micesllaneous garden flowers	Perth	18-5-32
		Kelmscott	16-9-32
Taeniothrips breviocornis (Bag.)	Hypochaeris radicata	Bridgetown	29-2-32
	Acacia pulchella	Harvey	24-9-32
	Eucalyptus sp.	Belmont	6-4-32
	Rosa sp.	Bridgetown	29-2-32
	Miscellaneous garden flowers	Queen's Park	6-4-32
Taeniothrips seticollis (Bag.)	Acacia sp	Mundaring	5-7-32
Taeniothrips spp ...	Acacia Baileyana	Caversham	27-7-32
	Acacia pulchella	Mt. Barker	29-8-32
		Bridgetown	6-9-32
	Acacia cyanophylla	Mt Barker	29-8-32
		Bridgetown	6 9 32
	Acacia extensa	Mt Barker	29-8-32
	Acacia alata	Kelmscott	16-9 32
	Eucalyptus rudis	Wooroloo	22 8 32
	Ageratum sp	Bayswater	6-8-32
	Chrysanthemum coronarium (Marguerite)	Maida Vale	21-10 32
	Miscellaneous wild flowers	Harvey	24-8-32
		Kalgan River	28 10 32
Microcephalothrips abdominalis	Zinnia elegans	Guildford	23-4 32
	Dahlia sp.	Perth	5-4-32
		Belmont	29-2 32, 7 3 32
	Miscellaneous garden flowers	Maylands	10-5-32
		Perth	18-5 32
Taeniothrips gladioli	Gladiolus sp	Perth	28th Dec
Isochaetothrips ignobilis	Eucalyptus sp.	Northam	11-4-32
Isochaetothrips uniformis	...	Perth	24-1-31
Frankliniella insularis (Frank.)	Dahlia spp	Perth	5-4 32
		Guildford	9-4-32
	Zinnia elegans	Guildford	23-4-32
	Eucalyptus sp	Belmont	6-4 32, 7-4-32
	Miscellaneous garden flowers	Belmont	29-2-32, 7-3-32
		Gosnells	12 3-32
		Narrogin	6-4-32
		Queen's Park	6-4-32
		Serpentine	10-4 32
		Maylands	10 5-32
Frankliniella nigripes	Miscellaneous garden flowers	Perth	18-5-32, 14-6-32
		Bayswater	4-6-32
Scholothrips sexmaculatus	Pyrus Malus (apple leaves)	Bridgetown	29-2-32
(Pergande) ...	Solanum nigrum (leaves)	Bridgetown	29-2-32
	Salvia leaves	Perth	14-4-32
	Convolvulus leaves	Guildford	..
Glaucothrips sp.	Miscellaneous garden flowers ...	Perth	14-6-32
Limothrips cerealium (Hal.)	Trifolium spp.	Guildford	13-11-32
Limothrips angulicornis (Jab.)	Unspecified	Claremont	24-11-32

RECORDS OF THYSANOPTERA—*continued.*

Species.	Host Plant.	Locality.	Date.
Anaphothrips	Acacia sp.	Jandakot	26-8-32
Anaphothrips newmani (Moulton)	Distorted leaves of Acacia sp. ...	Claremont	15-3-32
Anaphothrips varii (Moulton)	Trifolium spp.	Guildford	13-10-32
Pseudonaphothrips achaetus	Oxylobium capitatum ...	West Swan	13-8-32
	Rosa sp.	Guildford	29-1-32
	Miscellaneous wild flowers ...	Toodyay	11-4-32
		Maida Vale	17-6-32, 12-9-32
		Albany	6-9-32
		Mt. Barker	12-9-32
		Mundaring	12-9-32
		Kalgan River ...	28-10-32
	Miscellaneous garden flowers	Mundaring	9-5-32
Scirtothrips australiae ..	Leaf of Cyclamen indicum ..	Perth	29-4-32
Neophysopus sp.	Acacia pulchella	Mundaring	30-9-32
Agerothrips sp	Miscellaneous wild flowers ..	Mt. Barker	19-9-32
Australothrips, bicolor (Bag.)	Eucalyptus rudis (leaves) ...	Perth	Feb., 1931
	Hypocalymma angustifolium ...	Mt. Barker	12-9-32
	Eucalyptus calophylla ...	Mundaring	9-5-32
	Eucalyptus sp.	Baker's Hill ...	7-3-32
Heliothrips haemorrhoidalis (Bouche)	Vitis vinifera (grape vine) ..	Nedlands	13-1-31
	Quercus sp.	Perth	1931
	Acacia podalyriaefloia ...	Perth	16-5-32
Hercothrips bifasciipennis (Gir.)	Eucalyptus sp.	Baker's Hill	7-3-32
	Dahlia sp.	Claremont	28th Dec.
Parthnothrips dracaenae (Heeger)	Dracaena sp.	Perth	29-6-32

AEOLOTHRIPIDAE.

Species.	Host Plant.	Locality.	Date.
Desmothrips australis (Bag.)	Eucalyptus calophylla ...	Mundaring	9-5-32
	Acacia sp.	Spearwood	30-8-32
	Dahlia sp.	Perth	5-4-32
	Blossoms o. native trees ...	Toodyay	11-4-32
Desmothrips mendozai (Gir.)	Sweepings in bush	Mundaring	25-2-31
Desmothrips sp.	Oxylobium cuneatum	Mundaring	19-10-32
Melanthrips spp.	Acacia pulchella	Lesmurdie	22-9-32
	Acacia sp.	Jandakot	26-8-31
Cranothrips poultoni (Bag.)	Banksia Menziesii	Belmont	7-4-32
		Bibra Lake	22-4-32
		Gnangara	10-6-32
	Eucalyptus sp	Belmont	6-4-32
Lamprothrips maculosus (Moulton) (n.g. and n. sp.)	Eucalyptus rudis	Perth	20-12-28
Cranothrips spp. ...	Hakea prostrata	Jandakot	26-8-32
		Spearwood	21-10-32
	Miscellaneous wild flowers ...	Wooroloo ...	22-8-32
	Chiefly Hakea spp. and Acacia spp	Narrogin ...	26-8-32
		Albany	6-9-32
		(Unrecorded) ...	4-8-32
	(Unrecorded)	Albany	7-7-32
	Melaleuca radula	Lesmurdie	22-9-32
Rhipidothrips aureus .	Eucalyptus calophylla ...	Mundaring	9-5-32
	Eucalyptus spp.	Baker's Hill	7-3-32
		Gosnells	12-3-32
	Blossoms of native trees ...	Toodyay	11-4-32
	Eucalyptus spp. and Acacia spp.	Mundaring	30-5-32
Liothrips atratus (Moulton)	Sweepings in bush	Mundaring	25-2-31
Haplothrips victoriensis (Bag.)	Garden flowers	Perth	14-4-32
	Do	Belmont	7-3-32
	Do.	Queen's Park ...	6-4-32
	Dahlias	Perth	5-4-32
	Roses	Bridgetown	29-2-32
	Eucalyptus erythrocoris ...	Perth	10-3-32
	Eucalyptus sp.	Northam	11-9-32
		Baker's Hill ...	7-3-32
Haplothrips gowdeyi ...	Globe amaranthus	Perth	7-3-32
Haplothrips varius ...	Globe amaranthus	Perth	7-3-32
Haplothrips melanocerus ...	Garden flowers	Perth	27-2-32
Phaulothrips fuscus (Moulton)	Eucalyptus sp.	Bridgetown	15-11-27

ACKNOWLEDGMENTS.

For assistance in the identification of the species of thrips collected during the taking of the census, we are indebted to Messrs. Dudley Moulton, of California, and A. A. Girault, of Queensland.

For the naming of the host plants to our botany branch.

For financial aid in carrying out the work herein recorded we have to thank the West Australian Fruitgrowers' Association for the donation of £25.

ERRATA.

In the June issue of this Journal, page 246, spraying calendar for fruit trees, under the heading "Plague Thrips", appears a formula credited to Mr. W. Evans, officer of the Council for Scientific and Industrial Research. This should read one part of Pyrethrum to 8 parts of Flowers of Sulphur.

Also on page 249, under heading "Loquat—Soft Brown Scale," should read spray with white oil when scale present.

BACTERIAL WILT OF TOMATOES AND OTHER SOLANACEOUS CROPS.

H. A. Pittman, B.Sc.Agr., Plant Pathologist.

This disease is caused by the bacterial parasite, *Bacillus solanacearum.*

The organism attacks tomato, tobacco, peanut, eggplant, pepper, soybeans, geraniums, beans, potatoes, and many other cultivated plants widely separated botanically. On potato "vines" and the stems of the other plants mentioned, it causes a disease known as "bacterial wilt," and in potato tubers the disease known as "brown rot," "bacterial wet rot," "sore eye" disease, and so on.

It has only been recorded in this State on potatoes and tomatoes. Specimens of tomato plants affected by the disease have recently been received from Geraldton, in which area it may easily become a serious menace to the tomato-growing industry unless the proper precautions are taken by the growers concerned.

It causes a brown discolouration of the vascular ring of potato tubers from which, after cutting, if considerable pressure is used, bacterial slime may often be squeezed out. The bacterial slime becomes very obvious after leaving the cut sections of the potato tuber standing overnight in a moist jar. The bacteria work outwards and inwards from the vascular ring and in the course of time give rise to a soft rot of potato tubers, which often has a very objectionable odour. Sometimes the bacteria invade the eyes of tubers from the vascular ring and bacterial slime exudes. This is the "Sore Eye" condition.

The disease is often introduced on to a hitherto disease-free property in infected potato tubers.

In the stems of plants it causes a brown discolouration of the water-conducting tissues, which is not usually so dark coloured and is wetter-looking than in the case of Fusarium wilts.

Affected plants soon wilt and eventually die. The wilting may commence at any part of the above-ground portions of the plant, and an interesting feature is that a leaf or two may be badly wilted in the early stages of the disease while the rest of the plant is quite turgid (stiff) and looks the picture of health. The leaves do not usually die from the bottom of the plant upwards as is generally the case with Fusarium Wilt of tomatoes.

The disease may enter the plants through roots injured at transplanting time or by cultivation. It may also enter through eelworm galls on the roots. Another method is by means of chewing insects which may spread the disease from plant to plant. The disease may also be transmitted on the hands of workers during the pruning operations.

It is a disease of fairly high temperatures, thriving best at about 95 deg. F. Wet weather with high temperatures favours its development. In the Eastern United States it seems to be most prevalent on washed sandy soils which contain coarse gravel. The disease has been of considerable importance in potato crops grown on the sandy soils around Perth, especially where "round" seed has been planted, but little has been heard of it on heavy soils.

CONTROL.

1. Disinfect tomato seed in corrosive sublimate before planting, as fully indicated in Leaflet 336, obtainable free of charge on application to this Department. The same applies to potato "seed" which should be disinfected before cutting into setts. (See Leaflets 336 and 72, 2nd edition.)

2. Disinfect the seedbeds with formalin, as indicated in Leaflet 336, or else use an entirely new seedbed each year made up from soil on which no susceptible crops have been grown at any time, or for as long a period as possible.

3. Use rotation of crops; that is plant out into fields on which susceptible crops have either never been grown or have not been grown for 4 or 5 years, if possible.

4. Pull up all diseased plants as soon as noticed, "lock, stock and barrel," and destroy by burning or boiling.

5. Wash the hands carefully with soap after handling diseased plants and before touching any further healthy ones, so as to avoid spreading the organism while pruning, picking the fruits, etc.

6. When cutting potato tubers, have two knives, each standing in a separate container with the blade immersed in 10 per cent. formalin (say, 2 ounces formalin plus water to make 1 pint). As soon as a potato with any evidence of disease internally is cut, discard the potato and place the knife which has just been used into the formalin solution.

Then take the other knife out of its container and proceed to cut other tubers until further trouble is met with, when the procedure should be reversed.

7. Destroy all diseased tubers by boiling or by burying deeply in a place where they will not subsequently be disturbed and from where there will be no danger of infection being spread by flood, irrigation, or seepage, waters etc., later on.

8. Do not used "round" potato seed (that is, small, so-called "seed" potatoes), as if there is any disease present internally in some of the tubers, it often cannot be detected except by cutting. Use large tubers cut up into setts whenever there is any doubt about the freedom of the seed from internal visible or invisible parasites (viruses).

9. If the farm offers a variation in the types of soil, it is well to avoid coarse gravel or sand and select for the potato or tomato field a loam with plenty of humus.

10. Potatoes grown in relatively cool areas as, say, the Albany-Denmark area, should preferable be used for seed as this seed is grown under climatic conditions less favourable to the disease than is the case with hotter districts.

11. When obtaining potato "seed" or tomato seed, always obtain it, if possible, from disease-free crops. The same applies, of course, to the seed of any other plants.

12. So far as is known, this disease cannot be controlled by spraying with fungicides such as Bordeaux mixture or lime sulphur. Chewing insects which may spread it about, however, should be controlled by the use of arsenate of lead sprays or dusts or in some other suitable manner.

RELATIVE FOOD VALUES.

RELATIVE VALUES OF CONCENTRATES.

PERTH, SEPTEMBER, 1933.

Foodstuff.	Cost.	Cost per 100 lbs.	Starch equivalent per 100 lbs.	Digestible Protein per 100 lbs.	Cost per lb. of Starch equivalent.	Cost per lb. of Digestible protein.
		s. d.			d.	d.
Wheat ...	3s. per bushel of 60 lbs.	5 0	73	9·0	0·82	6·6
Oats ...	2s. per bushel of 40 lbs.	5 0	63	7·0	0·95	8·6
Bran ...	£5 12s. 6d. per ton	5 7½	48	13·0	1·40	5·2
Pollard ...	£5 17s. 6d. per ton	6 10½	61	13·5	1·15	5·2
Linseed Meal	14s. 6d. per 100lbs.	14 6	72	25·5	2·42	7·0
Meat Meal ...	15s. 6d. per 100lbs.	15 6	92	60·0	2·00	3·1
Peas ...	5s. per bushel of 60 lbs.	8 4	74	19·0	1·35	5·3

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

RECENT PUBLICATIONS.

The following pamphlets and bulletins of the Council have recently been issued and are obtainable, post free, on application to the Department of Agriculture:—

Pamphlet No. 38.—"The Occurrence of *Anaplasma marginale*, Theiler, 1910, in Northern Queensland," by J. Legg, D.V.Sc.

Pamphlet No. 39.—"The Grasslands of Australia and Some of their Problems: A Report upon the Dairy Pastures," by William Davies, M.Sc., Empire Grassland Investigator, Welsh Plant Breeding Station, University College of Wales, Aberystwyth.

Pamphlet No. 40.—"A Guide to the Seasoning of Australian Timbers," Part 1, by C. Sibley Elliott, B.Sc., Division of Forest Products.

Pamphlet No. 41.—"The Grading of Western Australian Timbers: Report on and suggested specifications for the grading of Jarrah and Karri, based on investigations in 1932," by F. Gregson, B.E., and R. F. Turnbull, B.E.

Bulletin No. 75.—*Nigrospora Musae n.sp.* and its connection with "Squirter" Disease in Bananas.

The August number of the Journal of the Council has also been issued. This is a quarterly publication giving progress reports on investigations not yet sufficiently advanced for publication in a final form. In addition, notes on the research activities of the Council are given. The annual subscription to the Journal is 5s., which should be forwarded to the Secretary, Council for Scientific and Industrial Research, 314 Albert Street, East Melbourne.

THE INFLUENCE OF RAMS ON THE FLOCK.

HUGH MCCALLUM, Sheep and Wool Inspector.

Rising wool prices should put new life into the sheep industry and induce sheep farmers to concentrate on the further improvement of their flocks.

In flock improvement the rams, if carefully selected, will play a very important part. They should be purchased from one of our registered stud-breeders who, generally speaking, are men who have made a life-long study of sheep-breeding or who, at least, have a far wider experience in sheep-raising than the average farmer. In purchasing from these breeders a sheep farmer, in addition to obtaining his annual supplies of rams, is gaining the benefit of their wider experience.

Again, he may be relatively sure of purchasing a ram of sound constitution. This quality in a sheep is of fundamental importance and is largely the product of hereditory influences which stud-breeders develop in their systems of breeding.

The system of registered breeding has one other great advantage. It enables flock owners, by referring to the register of Merino stud flocks (which is issued annually by the central organisations of stud-breeders throughout the Commonwealth), to select and purchase from a breeder whose flock was founded on a blood strain akin to that to which his breeding ewes belong. Having selected a breeder whose rams give satisfactory results, it is wise to purchase annual drafts of rams from him. Adherence to this policy will quickly bear fruit, providing the flock is carefully culled and well and evenly fed.

Before selecting rams it is wise to carefully study the flock of ewes in order to determine their weaknesses, and then to choose sires which are particularly outstanding where the ewes are deficient in order to correct these faults.

Good rams also exert a powerful influence on the covering of the sheep. They will quickly put body and style into the fleece if, as before, feeding and culling are carefully attended to. With rams as cheap as they are to-day, there is no reason why so many farmers (and there are still many) should place on the market clips of characterless merino wool.

Unfortunately, since the rapid decline in commodity prices, the tendency among flock owners has been to economise by reducing the number of rams used or buying sheep of inferior quality. This may, temporarily, be a source of economy, but it will soon lead to very great direct loss, for, just as a well-husbanded flock will rapidly improve if mated to good rams, so will it quickly deteriorate if mated to inferior sheep. It should rather be the policy of sheep farmers to make the best of one of the few advantages that are offered by the present condition of economic affairs, by buying high class sheep while they are available at ridiculously low prices. When the wool market improves, ram prices will rise accordingly, so now is the time to "get in on the ground floor."

On 3rd and 4th October, the leading stud-breeders of the Great Southern districts are conducting a sale of high class rams at Katanning, and the breeders in the Midlands district are holding a similar sale at Moora on 6th October. These will be followed by the annual Royal Show sales on 12th and 13th October. These sales should be well attended as, not only do they provide many farmers with an opportunity of making their annual purchases, but also they have a great educational value in that they teach growers to assess relative values in sheep and display to them the type of sheep which they must strive to breed.

PATERSON'S CURSE.

(*Echium plantagineum*, Linn.)

C. A. GARDNER, Government Botanist.

Paterson's Curse is a native of the Mediterranean Region and Western Europe, from where it has been introduced into other countries both accidentally and as an ornamental plant. Its common names are numerous. In Europe, where it is cultivated to some extent in gardens, it is commonly known as Viper's Bugloss, Echium being derived from the Greek Eches, meaning Viper. In South Australia it is referred to as "Salvation Jane" or "Blue Weed," while in this State it is also known as "Lady Campbell Weed."

The first record of this plant in Australia dates back to about 1895, when it was introduced as a garden flower to a place near Albury, in New South Wales, by a certain Paterson. It gradually spread until it encroached on a travelling stock reserve. After this the weed spread rapidly, particularly along the stock routes and in reserves, until it has now become widely distributed in the Eastern States.

Its local history is associated with the construction of the Great Southern Railway. Lady Campbell, wife of Sir Thomas Campbell, who was residing at the time not far from Broomehill, introduced this species as a garden plant, and from here it has become widespread, and is still known along parts of the Great Southern Railway as "Lady Campbell Weed."

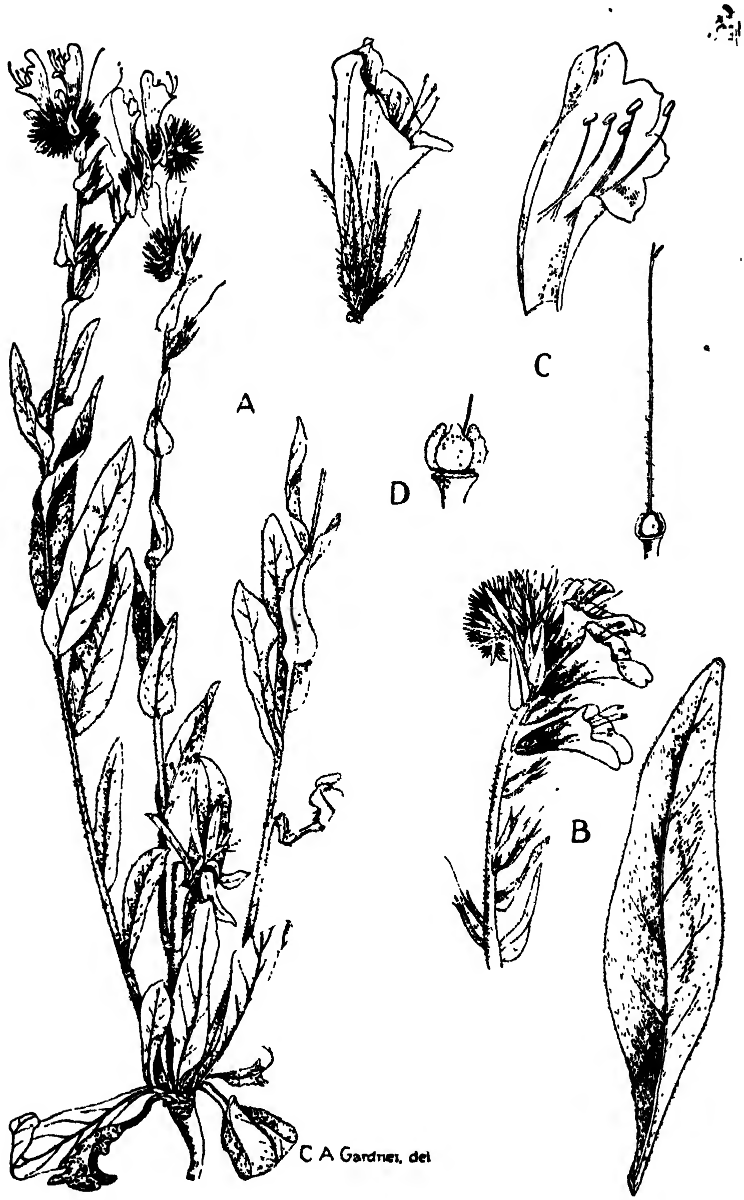
Paterson's Curse has now been reported in this State from various places along the Great Southern Railway, Boyanup, Donnybrook, Brookhampton, and Bridgetown in the South-West, Wooroloo, Swan View, Darlington, and Guildford, and from Gingin, Mingenew, and Perenjori. It has not been officially recorded from the Eastern districts.

Around Broomehill, Kojonup, and Boyanup it occurs very extensively, often covering large areas. Certain areas in the Boyanup district are very badly affected, and on one farm, in particular, where the weed has been established for some time, it has taken possession of about 25 acres. Further North it is more sporadic, but there is always the possibility of its spreading, and if unchecked, becoming very common. The early growth, which takes place in winter, consists of a number of basal leaves which lie flat on the ground, thus smothering the more frail vegetation underneath. When these leaves die bare patches remain, and the productivity of the field is greatly reduced. The plant is annual, biennial, or sometimes almost perennial in habit, and thrives on rich moist soils. After stooling and spreading during the winter, flowering stems are produced in spring. Each stem bears a considerable number of striking violet flowers, the reproductive parts of which give rise to single-seeded nutlets, which are easily distributed.

As is the case with a number of other weeds when first found, it has been spared for sentimental reasons owing to its attractive flowers. This is certainly dangerous when the free seeding nature of the plant is considered and the manner in which it is spread by stock.

There are two objectionable features of Paterson's Curse. In cereal crops it is particularly troublesome in crowding out the growing crops, and interfering with harvesting operations. In pasture lands it crowds out more valuable annual

pasture crops, and considerably reduces the dry feed value of the pasture. It is not likely to prove as troublesome in good permanent pasture land since the more vigorous grasses, such as Couch and Paspalum, are able to compete with it, or even crowd it out.



Paterson's Curse (*Echium plantagineum*, Linn.)

A.—Plant.
B.—Inflorescence and leaf.
C.—Flower and section of same (enlarged).
D.—Fruit (enlarged).

Paterson's Curse has some value as a fodder plant, but it must be emphasised that this quality is not one to make the plant a particularly desirable one. The plants are eaten by stock, when young. Where feed is scarce it may be quite useful, providing a succulent spring feed. The mature plants, however, are fibrous and harsh, and usually avoided by stock. Stock, however, will eat it if reduced to that extremity, but there is always a risk of the animals having digestive trouble. The weed has certainly received some praise from the drier areas of other States, hence the name of "Salvation Jane." Since these conditions do not obtain in our South-Western districts it is scarcely necessary to speak well of the weed on this account, and it should always be remembered that if other feed will grow, Paterson's Curse is an undesirable weed.

When the plant first appears it should be hand pulled and hoed, and a close watch kept of the area for further growth. Where it has become widely established, this method of eradication is not practicable, and heavy stocking or cultivation must be carried out. The plants are eaten, in their young stages of growth, by stock, and large numbers of animals should be placed on comparatively small areas at a time. This heavy grazing, repeated at intervals, should prove effective in controlling the weed. Stock grazed on Paterson's Curse, which is in seed, however, ingest the seeds which, being contained in nutlets, are not all digested, and are thus spread by the wandering animals. Another and efficient method of attack is cultivation which should be repeated when appreciable growth is made. This cultivation should commence in winter, prior to the formation of flowering stems, and in the following autumn, as early as the season permits, a vigorous smothering crop should be grown. The nature of this crop will vary for different districts, but subterranean and drooping flowered clovers make a good general base for this crop.

One point to be stressed is that the plants should not be allowed to produce flowers, for even if the flowers have just opened and the plants are pulled and thrown on the ground, seeds are likely to be formed. Unfortunately the weed burns badly, even when dry. The seeds retain their viability for a considerable number of years, and continue to germinate each year until the supply is exhausted. Thus, once the plant has become established and seeded, a careful watch must be kept for several years.

Hay, particularly clover hay, should not be obtained from affected areas, and care should be exercised when purchasing seed. Subterranean clover burr, in particular, should be avoided for this reason alone, if grown in areas where Paterson's Curse is prevalent. The nutlets can easily be eliminated from cleaned seed.

Description of Plant.

An annual or biennial herb of usually one or two and a-half feet, branching at the base with several erect stems, stout and hairy. Leaves mostly basal, the basal large and oval-lance-shaped, stalked, the upper leaves smaller, without stalks and heart-shaped at the base. Flowers violet, in long curved racemes, each flower subtended by a leaf-like bract. Calx deeply divided into five acute lobes, hairy with stiff white hairs. Corolla tubular, bell-shaped, about three times as long as the green calyx. The fruit consists of four small wrinkled nuts, which fall out of the base of the persistent calyx. The flowering season is September to November; the plant seeding about the same time, or into December.

TOXIC PARALYSIS OR BOTULISM.

Twenty-one Points for Attention.

1. Toxic paralysis is a disease which is prevalent in the agricultural areas during the summer months.

2. Horses are rarely affected, cattle and sheep to an enormous extent in some areas in Western Australia.

3. **AS NO CURE IS KNOWN TOXIC PARALYSIS MUST BE PREVENTED.**

4. The direct cause of this disease is a germ toxin or poison which is swallowed by stock and which is found in decomposing animal matter, bones, rabbit and other carcases, and in decaying vegetable matter like mouldy or damp hay.

5. Stock can therefore become affected if they develop an unnatural or depraved appetite and lick or eat contaminated bones or rabbit or other carcases (affecting generally sheep or cattle), or if they eat contaminated hay, etc. (affecting generally horses).

6. A depraved appetite is caused by a deficiency of one or more food constituents in the daily food supply.

7. The dry summer pasture in Western Australia contains insufficient nutriment to meet the maintenance requirements of wethers and store stock.

8. For milking cows, wet ewes and growing animals, the deficiency in the summer grazing is much greater.

9. The natural difficulties in this connection have been intensified by the depredations of the rabbit pest.

10. Cereal stubbles, exclusive of shed grain, are entirely inadequate for the needs of stock in the summer.

11. A sheep cannot eat sufficient stubble to supply more than three-quarters of the energy or heat producing material, one-third of the protein, or one-sixth of the phosphate required by a full-grown ewe.

12. Half a pound of oats or 1 lb. of good hay daily to supplement the stubble would still supply insufficient protein and phosphate.

13. Sheep grazing solely on stubbles or dry natural feed are, therefore, most likely to develop a depraved appetite, followed by toxic paralysis, when contaminated material like rabbit carcases or bones are available.

14. The deficiencies in the summer grazing should be made good in order to prevent the depraved appetite and toxic paralysis.

15. Toxic paralysis has been prevented in many cases by feeding a phosphatic lick of satisfactory strength in sufficient amounts.

16. In other cases the trouble is due to insufficient nutriment generally. It is then necessary to supplement the natural feed with a ration of oats or lupins ½ to 1 lb., or hay 1 to 2 lbs. daily.

17. The standard dicalcic phosphatic lick recommended consists of:—

Dicalcic phosphate	45 parts.
Salt	40 parts.
Molasses	5 parts.
Water to condition	10 parts.

or—

Dicalcic concentrate	50 parts.
Salt	50 parts.

This lick contains 18 per cent. phosphoric acid (P_2O_5).

18. Dry cows on summer pasture require 5 ozs. dicalcic lick per day; milking cows require, in addition, 2 ozs. dicalcic lick for each gallon of milk produced.

19. Sheep on dry summer grazing require at least fourteen (14) pounds of this lick per hundred per week.

20. If much more than this is consumed an appetite for salt is indicated. In this case a lick consisting of—

Dicalcic concentrate	50 parts
Salt	100 parts

is recommended. This lick contains 10 per cent. phosphoric acid (P_2O_5).

21. Further information may be obtained from the Department of Agriculture, Perth.

THE COMPOSITION OF SOME COMMON WESTERN AUSTRALIAN STOCK FOODS.

GEO. L. SUTTON, Director of Agriculture.

Because of the increasing attention which is being given by stockmen in Western Australia to the relative nutritive value of stock foods, Tables I. and II. hereunder, containing information relative to the composition and food value of stock foods in common use, have been prepared by Agricultural Advisers L. C. Snook, B.Sc., Agr., and G. L. Throssell, Dip. Agr., after consultation with other officers also interested in this work.

As further data is accumulated it may be necessary to amend some of the figures now given, but, as far as can be gauged from the details now available, the information in the table hereunder may be accepted as a good index of the composition and food value of the stock foods to which they refer.

In Table 1 will be found the percentage composition and the digestion coefficients of the different stock foods. For those not familiar with such tables, it is necessary to point out that the composition of any food is not constant but varies as the result of many factors. The analyses selected and included are those, which after consideration of the information available, are regarded as being representative of the food to which they refer and as grown under local conditions. In the absence of local digestion trials to provide digestion co-efficients for the different foodstuffs, those obtained in other countries for the same or similar stock foods have been accepted and used.

In Table 2 will be found the percentage composition of the dry matter and its nutritive value calculated from its digestible nutrients. The production starch equivalent has been calculated according to the Kellner formula, in accordance with which the percentage availability of the fodders is a value "V" introduced by Kellner, and now generally adopted by British authorities. This "V" value is shown under the heading V. The nutritive ratio has been calculated according to the formula:—

(Digestible fat × 2.3 + Digestible Carbohydrates + Digestible Fibre) ÷ Digestible Crude Protein.

Table 1.

Foodstuff.	Percentage Composition.								Digestive Co-efficients.				
	Dry Matter.	Crude Protein.	Crude Fat.	Nitrogen Free Extract.	Crude Fibre.	Total Ash.	P_2O_5.	CaO.	Crude Protein.	Crude Fat.	Nitrogen Free Extract.	Crude Fibre.	"V"
Grains and their By-Products—													
Barley (feed)	88	11·0	2·2	68·0	4·5	2·3	0·82	0·06	74	80	92	50	98
Lupins	86	29·5	6·2	36·2	11·2	2·9	...	...	80	80	90	57	88
Maize	87	9·9	4·4	69·2	2·2	1·3	0·63	0·05	74	93	94	57	100
Oats	88	9·0	5·0	58·5	11·5	4·0	0·93	0·15	78	80	80	25	95
Peas—Field	88	22·5	1·6	55·5	5·4	3·0	0·84	0·098	86	60	93	40	98
Wheat	88	11·3	2·0	71·0	2·3	1·5	0·70	0·048	80	70	90	40	95
Bran—Wheaten	88	16·0	2·0	58·0	8·0	4·0	1·87	0·057	80	70	70	30	80
Pollard—Wheaten	88	17·0	3·0	60·0	5·0	2·5	...	...	80	86	80	30	80
Linseed	93	24·2	36·5	22·9	5·5	3·9	1·4	...	85	95	83	70	96
Linseed Meal	88	30·0	4·0	40·0	8·4	5·6	1·70	0·51	85	95	83	70	96
Meat Meal (W.A.)	92	64·0	15·7	2·3	2·0	8·0	3·66	...	93	98	50	...	100
Green Fodders—													
Green Lucerns—Bud Stage ...	20	5·0	0·8	8·4	3·0	2·8	...	...	75	50	75	70	80
Full Flower ...	25	4·75	1·0	11·25	5·0	3·0	0·19	...	75	40	70	40	74
Green Fodder Maize	22	1·9	0·6	13·0	5·3	1·2	0·11	...	60	75	75	65	82
Rape	14	2·8	0·8	5·7	3·5	1·2	...	...	89	49	92	87	87
Subterannean Clover—Young ...	18	4·3	0·3	8·7	3·15	1·5	0·252	0·18	80	60	80	80	92
Hay Stage	25	4·5	0·7	12·5	5·0	2·25	...	...	60	55	65	55	75
Mature ...	90	8·1	1·8	44·1	27·0	9·0	...	...	50	50	60	50	60
Sudan Grass—2ft. high ...	22	3·6	0·8	8·2	5·7	3·7	...	...	80	60	80	70	85
In Flower ...	40	4·7	0·6	17·0	13·9	3·8	...	...	65	60	75	60	80
Silage—Mixed Clovers and Grasses	25	3·5	1·0	10·5	7·5	2·5	0·14	...	60	70	60	60	70
Dry Roughages—													
Lucerne Hay	92	15·0	1·8	36·0	30·2	10·0	·54	1·95	90	39	72	43	57
Meadow Hay—Clovers and Grasses	88	9·0	2·0	41·6	29·0	6·4	0·41	...	60	55	65	55	70
Oaten and Wheaten Hay—Cut at Flowering stage	88	7·0	2·0	5·0	21·0	6·0	0·18	0·37	60	55	65	55	70
Wheat Straw (Stubble) ...	92	3·1	1·5	44·8	37·4	5·2	...	...	23	31	37	50	38
Oat Straw (Stubble)	89	3·6	2·4	41·3	36·3	5·4	...	...	28	39	51	60	43

TABLE 2.

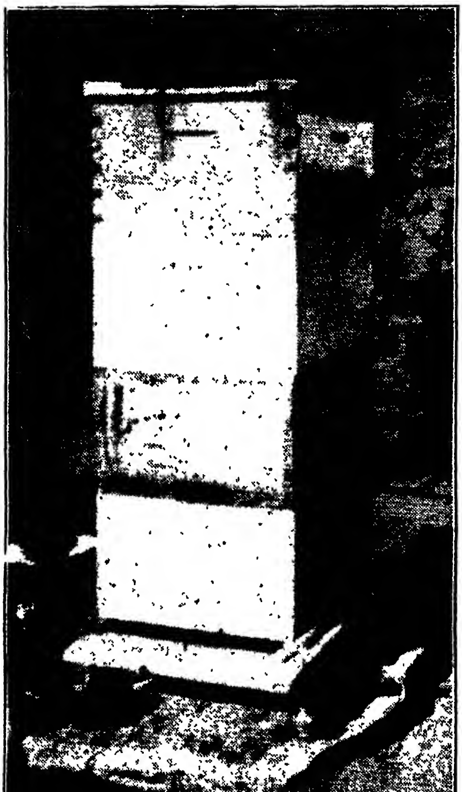
Foodstuff.	Composition of Dry Matter.							Digestible Nutrients in Dry Matter.					Nutritive Ratio 1:
	Crude Protein	Crude Fat.	Nitrogen Free Extract.	Crude Fibre	Total Ash.	P_2O_5.	CaO.	Digestible Crude Protein.	Production Starch Equivalent.	Total Ash.	P_2O_5.	CaO.	
GRAINS AND THEIR BY-PRODUCTS—													
Barley (feed)	12·5	2·5	77·3	5·1	2·6	0·93	0·07	9·3	85	2·6	0·93	0·07	8·4
Lupins	34·3	7·2	42·1	13·0	3·4	...	...	27·4	75	3·4	...	...	2·1
Maize	11·4	5·1	79·5	2·5	1·5	0·72	0·03	8·4	94	1·5	0·72	0·03	10·3
Oats	10·2	5·7	66·5	13·0	4·6	1·05	0·18	8·0	71	4·6	1·05	0·18	8·3
Peas—Field	25·6	1·8	63·0	6·2	3·4	0·95	0·11	22·0	84	3·4	0·95	0·11	2·9
Wheat	12·8	2·3	80·7	2·6	1·6	0·79	0·055	10·2	83	1·6	0·79	0·06	7·5
Bran—Wheaten	18·2	2·3	66 0	9·0	4·5	2·12	0·066	14·6	54	4·5	2·12	0·07	3·6
Pollard—Wheaten	19·3	3·4	68·2	5·7	3·4	...	...	15·5	80	3·4	...	...	5·6
Linseed	26·0	39·2	24·6	5·9	4·2	1·5	...	22·1	129	4·1	1·5	...	5·0
Linseed Meal	34·0	4·6	45·4	9·6	6·4	1·9	0·58	29·0	80	6·4	1·90	0·58	1·8
Meat Meal (W.A.)	70·0	17·0	2·5	2·2	8·7	3·94	...	65·0	100	8·7	4·0	...	0·62
GREEN FODDERS—													
Green Lucerns—Bud Stage ...	25·0	4·0	42·0	15·0	14·0	...	...	19·0	52	14·0	...	...	2·4
Full Flower ...	19·0	4·0	45·0	20·0	12·0	0·76	...	14·0	42	12·0	0·76	...	3·0
Green Fodder Maize	8·6	2·6	60·0	23·6	5·4	0·5	...	5·0	57	5·4	0·50	...	13·0
Rape	20·0	5·7	40·7	25·0	8·6	...	...	17·8	58	8·6	...	...	2·9
Subterannean Clover—Young ...	23·8	1·7	48·5	17·5	9·0	1·4	1·00	19·0	68	9·0	1·4	1·00	2·9
Hay Stage	18·0	3·0	50·0	20·0	9·0	...	...	10·8	44	9·0	0·6	...	4·4
Mature ...	9·0	2·0	49·0	30·0	10·0	...	...	4·5	30	10·0	0·4	...	10·0
Sudan Grass—2ft. high ...	16·4	3·7	37·4	25·9	16·6	...	...	13·1	54	16·6	...	...	2·6
In Flower ...	11·8	1·4	42·5	34·7	9·6	...	...	7·7	49	9·6	...	...	7·0
Silage—Mixed Clovers and Grasses	14·0	4·0	42·0	30·0	10·0	0·56	...	8·4	40	10·0	0·56	...	6·0
DRY ROUGHAGES—													
Lucerne Hay	16·3	2·0	39·1	32·8	10·9	·59	2·11	11·41	31	10·9	0·59	2·11	3·9
Meadow Hay—Clovers and Grasses	10·2	2·3	47·2	33 0	7·3	0·46	...	6·1	40	7·3	0·46	...	8·6
Oaten and Wheaten Hay—Cut at Flowering stage	8·0	2·3	59·0	23·9	6·8	0·20	0·42	4·8	41	6·0	0·20	0·42	11·0
Wheat Straw (Stubble) ...	3·4	1·6	48·7	40·7	5·7	...	...	0·8	15	5·7	...	...	49·4
Oat Straw (Stubble)	4·0	2·7	46·4	40·8	6·1	...	...	1·1	22	6·1	...	...	46·0

CARNIOLAN BEES.

H. WILLOUGHBY LANCE,
Apiculturist.

Since writing in the "Journal" in June, 1931, on Carniolan Bees, further experience has been gained with them, and all that has been said in their favour has been maintained, and they are rapidly increasing in favour and popularity, so much so that the Department could not fulfil all the orders for queens last season.

The old prejudice against them, that they were great swarmers, has been proved wrong. We can only speak for the strain that we are handling. Other strains may be different, just as Italian strains vary. One instance is given. Messrs. McNamara Bros., of York, who are Carnaising their apiaries as rapidly as



possible, left one of their out apiaries unvisited longer than usual early last season, as they did not think there was much honey coming in. When they did inspect it, they found that there had been a honey flow and half the colonies had swarmed. All of these were Italians. The Carniolans had not swarmed, but were storing honey in the brood chamber.

Other beekeepers are continually writing in saying how satisfied they are with the Carniolans, and the following are a few extracts from letters:—

A beekeeper at Denmark wrote—"I must say I am more than satisfied with the Carni queen you sent me."

A beekeeper at Narembeen, writing on November 18th, 1932, said: "I must tell you that as regards Carniolan bees, they are jolly hard to beat. I had a look at mine on the 9th and got a surprise to see ten full depth combs filled with honey and sealing from the top bar. This colony has built up very strongly since I purchased it on the 24th September. At present I have made it into three stories and all the bees cannot get in at night when they all return." (Note this is less than two months.) "The last Carniolan queen I received from you has laid hot and strong since I have had her. In fact, I am sure she is a better queen than the other. I made a test to see what she did lay and she filled a comb in three and a half days, in which I counted 7,290 cells. The other hives of bush bees are fairly strong, but very little honey in store. On the test between the two lots, I am satisfied Carniolans will do me, and next year I will have more."

On February 1st he wrote again:—"Beekeeping is going at full swing up here. I have been increasing a few more colonies of Carnis by two queens which I was successful in breeding. I took the brood from one hive and put it in a queenless hive of bush bees, which had no eggs or brood whatever. They built five good queen cells on the combs, but I only had luck in securing two. The queens were mated with drones from the first colony of Carnis I got from you, and have been laying for four weeks now, and the bees produced from the queens are just the same as the others. I am enclosing herewith photo. of the hive of Carni bees which I received from you in September, 1932, as a nucleus."

In February, 1933, we visited a beekeeper at Pemberton, to whom we had supplied a nucleus in September, and found that the nucleus had increased to two hives, one being 2 storey, 10 frames; and one 3 storey, 10 frames.

As regards their gentleness, we seldom use a veil at Rottnest, even when getting down to the brood chamber of a 4-storey hive.

THE CLEANSING OF MILKING MACHINES.

M. CULLITY, Agricultural Adviser, Dairy Branch.

Cheaper methods of clearing, the use of Subterranean clover and the practice of top-dressing have made possible the development, on a rapid scale, of our pasture areas. As a consequence the carrying capacity of most farms has increased, and, with the further expansion of the dairying industry the tendency will be to a greater extent towards larger herds. These have been increasing gradually for some time and where the properties are capable of carrying more stock than can be handled easily by the labour normally available, the owner has to decide, either to increase his herd of milch cows, or to buy dry stock for fattening. Should the decision be to increase the herd, further labour must be employed or else a milking machine purchased. Usually it will prove more economical to purchase a machine than to employ extra men solely because of the necessity of having additional assistance at milking time. That this is so is shown conclusively by a survey carried out in U.S.A. where 1,160 users of machines were queried, with the following results:—

(1) Over 34 per cent. said milking machines saved more than 2 hours per day.

(2) Over 14 per cent. said they saved 50 per cent. in time and labour.

(3) Over 25 per cent. said they saved the entire time of one man.

Further in a survey of dairy farms in the Murray Valley of Victoria and South Australia in 1929 it was shown that with small herds the labour income was lower with machines milking than with hand milking. With the larger herds, however, considerably higher labour incomes were received where machines were used. It may be assumed therefore that the larger the herd, the great the profit will be, on installing a machine. The decision to purchase a machine will be assisted in many cases by the knowledge that the care of a machine is not onerous. Unfortunately the point is not appreciated that, although some efficient methods of caring for a machine may be easy, all easy methods may not be equally successful. Further, many of the so-called easy methods are undoubtedly expensive, in as much, as the cash losses, as a result of inferior cream, may far outweigh the value of the time saved in the cleaning. Generally, it may be stated, that the farmer using a machine is genuine in his desire to produce a sanitary product, and his failure to achieve this object is often due to a misconception of the ideals of dairy sanitation. Often great faith is held in costly cleansing preparations and much expense and worry are incurred uselessly in trying to improve the product. A cleansing material of some nature is, of course, necessary for removing greasy deposits left by the milk in the rubbers and pipe lines, and for this purpose nothing has yet been evolved which would do this work more thoroughly or more cheaply than a solution of soda. Precautions, however, are necessary in using a soda solution, as if any of this obtains access to the milk the result is very damaging. Further, if the solution is left in contact with tinware, corrosion will occur. The precaution against this is obvious and simple. A thorough rinsing following the soda solution will obviate any danger. What is usually overlooked, however, is the bacterial contamination that takes place throughout the teat-cups, rubbers and pipe lines. These may look clean and smell clean but still have a very harmful effect on the milk produced. Usually an average of 12 hours elapses between milkings and the atmosphere of the pipe lines, etc., is no more pure than the surrounding air in the shed and yards. Where brushes and scrapers are used in cleaning, the rubbers and teat-cups become scoured and scored and occasionally receive deep cuts. These marks prove effective lodging places for accumulations of dirt and grease, which become decomposed by bacterial action. These act as contaminating centres by pouring direct to the milk stream quantities of bacteria, and break down products from the accumulated dirt which detract immediately from quality, or which, if not developed sufficiently to be detected on the grading floor of the factory, may cause great harm to the keeping quality of the butter manufactured.

In view of the foregoing, investigations carried out at the instance of the Royal Commission on the metropolitan milk supply, 1925, are exceedingly interesting. Investigations were carried out to compare the results of hand-milking with those of machine-milking, and to determine the importance of various factors involved in the production of whole milk. The following table summarises the data collected and will give some idea of the extreme difficulty experienced in obtaining high quality milk with the use of milking machines unless operated with more than ordinary care.

	Organisms per c.c.	Bacillus coli per c.c.
A. Hand-milking dairies (ordinary conditions) ..	52,120	135
B. Hand-milking dairies (special precautions) ..	3,900	40
C. Hand-milking dairies (private cows)	900	—
D. Machine-milking dairies (ordinary conditions) ..	694,504	743
E. Machine-milking dairies (special conditions) ..	60,000	197
F. Machine-milking dairies (Investigation National Institute of Dairying, Reading	1,000	—

(A) **Hand-milking dairies under ordinary conditions. Dairies were visited during milking, which was carried out in the dairyman's usual method.**

(B) Simple alterations were made to dairyman's routine and samples were taken at the point of delivery to customers. The precautions taken were only reasonable cleanliness on the part of the milker, washing hands, etc., the washing of udders, the rejection of the first jets from each quarter, the scalding of all utensils *before use,* and the use of ice tubes in milk to be stored over night.

(C) Milk from private cows. Absence of dust, etc., and the easier achievement of cleanliness in general. Only simple precautions were taken. The udder and teats were wiped with wet and then dry cloths. The flank was wiped with a dry cloth. The first jets from each teat were rejected.

(D) Samples were taken in a similar manner to A, from milking machine dairies.

(E) Represents samples taken from machines cared for under better than average conditions. Attempts were made, unsuccessfully, at two dairies to improve the counts.

The methods employed at the two dairies mentioned were as under:—

1. "After each milking, cold water, followed by hot water and soda, followed by hot water, was drawn through the machine. The movable parts were placed in the milk room until morning, two or three times a week the cups were completely dismantled and cleaned with hot water and brushes."

2. "After one milking cold and then boiling water was pumped through, and the parts were placed in the milk room. After the next milking, cold and then boiling water was pumped through, and the machine was completely dismantled, washed with brushes, hot water and soda, and then immersed in ordinary cold water until assembling for next milking. The washing process was very thoroughly done."

It is possible that, had the altered methods been used for several days before taking samples, other results would have been obtained. Once teat-cups and rubbers begin to absorb dirt and grease they cannot be cleaned up satisfactorily in one operation. This was definitely shown during the same investigation. At one dairy where the machine had not been dismantled for some days, bacterial counts of 947,000 total and thousands of Coliform bacteria were obtained. The machine was dismantled and was treated by special methods. The parts were scrubbed in water at 170 deg. F. for several minutes. The buckets were well washed with water at 200 deg. F. At the following milking, counts as under were obtained:—

270,400 total 238 Coliform Bacteria.

150,080 total 904 Coliform Bacteria.

This illustrates the point that when a machine becomes a serious contaminating agent, it is extremely difficult to bring it back to a sanitary condition within a short space of time. The writer has seen this demonstrated on many occasions, when milking machines were responsible for the cream produced being of inferior grade. Usually a period of days elapses under improved methods of cleaning before a choice cream can be produced. In one case where the vacuum system was badly contaminated, a full fortnight elapsed before choice cream was obtained.

(F) See later, under reference to vacuum system.

It will be noted that in the methods used in the investigations referred to, brushes played an important part. It is accepted that the use of brushes on rubber ware will cause the surfaces to lose their fine smooth texture and to become pitted. When used carelessly the surfaces may even become cut. It seems probable therefore that the rubber-ware on the machines tested were in a condition whereby contamination was continuous irrespective of the method used. Possibly

if new rubbers had been fitted to the machines and washed for several days under the altered conditions improved counts would have been obtained. However, new rubbers and teat-cups do not necessarily mean no contamination, as one sample during the investigation, taken from a machine which had been in use for 10 days only, showed a count of 624,000 total and 1,888 coliform bacteria. This should demonstrate the rapidity with which improper methods of cleaning can do great harm. More recent work in milking machines, however, has shown that a sanitary product can be obtained easily, while at the same time the life of the teat-cups and rubber-ware can be lengthened. In the method to be described no brushes or

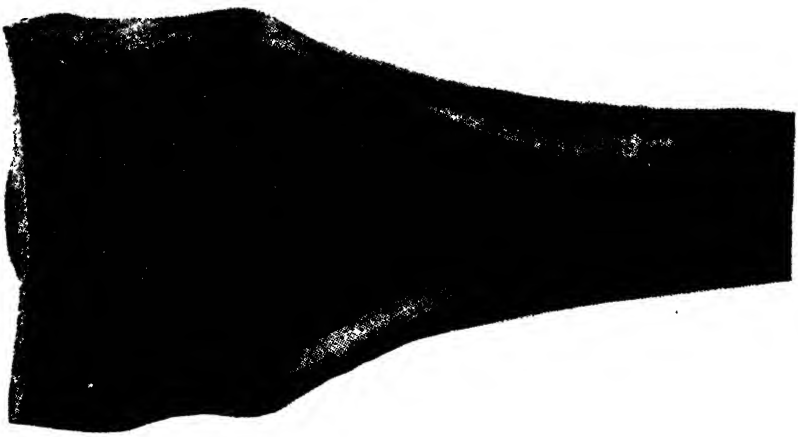


Fig. 1.—Long Milk-rubber after Twelve Months' Use and cleaning daily with Boiling Water, Washing-soda, and the use of a Brush and Scraper.

Note the scored inner surface of the tube.

(*By courtesy N.Z. Dept. Agric.*)

Fig. 2.—Claw-tube Rubber from the same Machine as Milk-tube in Fig. 1 The Indentations indicate effect of Lodgment of Grease.

(*By courtesy N.Z. Dept. Agric.*)

scrapers except for the outside of the teat-cups and the buckets, are required. The solution used removes all grease readily and causes the surface of the rubbers to become glazed. Naturally this renders the adherence of dirt difficult and reduces direct contamination to a minimum. Caustic soda is used as the cleansing agent, and if instructions are followed fully there can be no danger to the metal parts of the machine or the milk. Thorough rinsing will remove any trace of the solution.

This system is being used largely in New Zealand, Victoria, and New South Wales, with great success and has been described briefly by J. W. Smith in the New Zealand Journal of Agriculture. The procedure is as under:—

1. Before milking, draw cold water through all milk tubes and the releaser, so as to prevent the adhesion of milk to the pipes, etc.

2. Immediately after milking wash all dirt off the outside of the teat-cups and rubbers, then draw through each set of teat-cups sufficient cold (or preferably warm) water to flush out the milk system. When drawing the water through the set farthest from the releaser, insert a ball of horse-hair in the end of the milk pipe to cause it to travel through to the releaser with the water.

3. Next draw through *each set* of teat-cups *not less than one gallon of boiling water* to which caustic soda has been added at the rate of *not less than 1 to 1½ tablespoonsful per 4 gallons of boiling water.* Distribute the solution as evenly as possible through each set of teat-cups.

4. Immediately follow by flushing out the caustic soda solution with 2 gallons of hot water or 1 gallon of *boiling water* for each set of teat cups; the flushing with boiling water helps to dry the rubbers and leaves the milk system dry and sweet.

5. Then remove or open the plug or flap from the releaser pipe to allow of free circulation of air.

6. Next *clean the vacuum system* in the same manner as the milk system by drawing through first the caustic soda solution, and next the boiling water which has been circulated through the milk system. Pay particular attention to the cleaning of the pipe connecting the releaser to the vacuum tank; by flooding the releaser to cause the water to travel through to the vacuum tank. This is important.

7. The engine can now be stopped. *Disconnect the two long rubbers* from down-pipe and teat-cups and hang in a clean, airy place out of the sun.

8. Next disconnect the releaser, wash, rinse, and place in a clean dry sunny place, then disconnect the top or bottom half of the vacuum tank and treat in a similar manner. *To be successful these operations must be carried out daily.* This does not dispense with the necessity of dismantling the machine as often as possible so that joints and crevices may be examined and treated.

The method described above follows directly the general directions given for the cleansing of dairy equipment, *i.e.* (a) the removal of albumen and curd by rinsing in luke warm or warm water; (b) a thorough washing and scrubbing in hot water with some cleansing agent; (c) sterilisation. To be successful this method must be used daily. All greasy deposits are instantly removed by the caustic soda solution, and this is in its turn removed by the boiling water. It does not do away with the necessity of dismantling the teat-cups, etc., as often as possible and to give a complete overhaul so that crevices and joints may not become a source of contamination. With this method, in a short time, the interior surfaces of the rubber tubes and teat-cups become coated with a glass-like substance which reduces the possibility of grease and dirt lodging thereon. The discarding of brushes, etc., means that scoring and cutting is prevented, and the rubbers enjoy a much longer life.

The most neglected part in many machines is the vacuum system. From this, when not kept in order, a fine spray of bacteria-laden moisture is continually being poured into the milk. On a casual examination it often appears difficult to realise how this contamination can come about. Leaks in teat-cups, spray drawn back

from the releaser, the condensation from water vapour given up from the warm milk, cause the lodging of water in system; if this is not removed the multiplication of bacteria takes place and portion of this contaminating fluid is mixed with the whirling atmosphere as spray in the system at succeeding milkings.

Trials carried out by the National Institute of Dairying, Reading, England, show the importance of proper care of this portion of the machine. Two milking machines in common use were tried. One was washed in the system suggested by the makers, and parts of the other in contact with the milk, sterilised. It was found that variable results were obtained, but sometimes good counts were followed soon after by very bad results; investigations of points which were thought might have an influence, such as, more thorough cleansing, the quality of air drawn into the receiver when the teat-cups were removed from one cow to another, gave no results which would account for the large variation being obtained. However, when the vacuum system was examined it was found that water collecting in the pipe

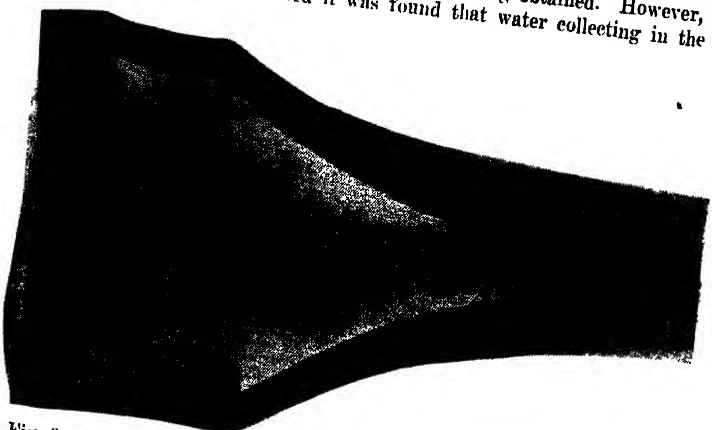


Fig. 3.—Long Milk-rubber after Two Seasons' Use and cleaning daily by the Caustic-soda-and-boiling-water Method.

(*By courtesy N.Z. Dept. Agric.*)

Fig. 4.—Claw-tube Rubber from the same Machine as Milk-tube in Fig. 3.

(*By courtesy N.Z. Dept. Agric.*)

line was heavily laden with bacteria. That this water was reaching the milk was then proved. Attempts were then made successfully to obviate all possibility of this occurring. An immediate improvement was noted in the bacterial counts of each machine. Those obtained by the sterilised outfit were particularly good: nearly

70 per cent. of the samples showing under 1,000 per c.c. The improvement of the other machine was also remarkable, although a small number of samples still showed very large counts, particularly during warm weather. The improvements found necessary by this investigation are nearly all standard in modern machines, e.g., the sloping vacuum line, vacuum supply taps taken off from the top of the pipe line, etc., etc. However, the mode of operation adopted by the farmer is not standard. Perhaps the most important suggestion made in the actual operation of the machines was to draw air through the system with all taps open for three minutes before and three minutes after each milking; this having the effect of drying out all moisture in the pipes. The necessity for keeping the vacuum system in a perfectly clean condition is therefore obvious. Section 6 of the instructions give a definite routine for carrying out this work. This should not under any circumstances be neglected.

Generally, the main features to bear in mind are: (1) use cold water to remove milk so that greasy deposits are avoided; (2) boiling water both for the soda solution and for the final rinsing. This in itself, apart from visible cleansing, will kill many germs and will heat up the machine to a temperature at which it will dry out completely. Wetness continuing on a dairy utensil for any length of time after washing, denotes definitely that the work has not been carried out efficiently. Information on the sterilising of separator parts, buckets in a manner suitable for adoption on farms at a small cost, may be found in the Journal of Agriculture, W.A., December, 1931. "The Cleansing of Dairy Utensils" by G. K. Baron-Hay; (3) store teat-cups and rubber tubes in clean atmosphere out of the sun, bearing in mind always that the atmosphere of a cowyard is not a clean one, and therefore there is a necessity to keep all parts which are removable in a purer air; (4) precautions should also be taken to see that contamination does not occur again before milking. The use of boiling water throughout the machines prior to milking and then cooling it again before milk is actually drawn will also help to hold the cost of the milk produced at a minimum.

Occasionally, more particularly where rubbers have been washed under another system and then a change is made over to caustic washings, complaints are heard that the rubbers commence to soften, and that they remain greasy. This usually occurs either at the point of junction of two lines, *e.g.*, where the long rubber fits on to a downpipe or where the interior of the rubbers are badly scored. It is the result of the soda solution gaining access to the bottom of the cuts or between the rubber and a metal pipe where a rinsing will not remove it. However, this does not occur on new rubbers on which brushes or scrapers have not been used. If the rubber tubes are not left connected up to the pipe line between milkings, the soda solution will not be able to do any damage.

The method has been used with success under Western Australian conditions, and the farmers who have used it have no hesitation in recommending it. One farmer who adopted this method writes:—"For cleanliness, effectiveness, quickness, and simplicity, this method is on its own." This farmer also stresses the point of using boiling water. He says further, "I find one never need have any fear of second-grade when using this method. I have been using a milking machine now for four years and have tried every known and unknown method of cleaning with all sorts of results, never getting much satisfaction, but a lot of work and worry, until you advised me of this method. The season before we cleaned the machine in the old way and I would not like to tell you of the results. It was awful. In one month we got 50 per cent. second-grade and that was not all." Other farmers using the method are also enthusiastic in praising its advantages, having in some cases almost completed the second year of its practise.

VINE PRUNING.

By H. K. JOHNS, Viticulturist.

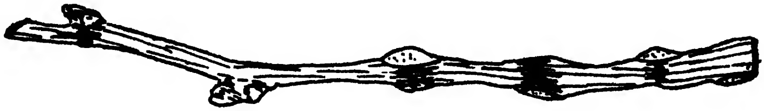
"The use of the grape as a food preceded the making of wine. Primitive man, who lived by the chase and on wild fruits, gathered and ate with relish the grapes of the wild vines long before he discovered that he could make a joyous beverage out of them. As time rolled on and life became more settled, he took in the grape vine from the wilderness and gave it cultivation. Then, perhaps, began the selection of the finest and best flavoured grapes, and, presently, the propagation of strains. Left to itself, deprived of man's ceaseless, thoughtful care, the grape vine would revert speedily, helplessly, to the status of its wild progenitor."—(*Extract from "Wine Lands of the World."*)

Therefore, to prune intelligently, many aspects have to be taken into consideration—the age, size, condition of the plant, the location, soil, climate, variety (whether it requires short or long pruning), the principles governing its life, and other features of its environment. Of all fruit-bearing plants, the grape vine is one that requires careful pruning, and like all other fruiting plants, it responds to pruning, and the quality of fruit is improved by it. Pruning has one or more of the following objects:—Modification of shape and habit of the plant, removal, renewal, promotion, or retarding parts of the plant, increase or decrease in size and quantity of the fruit, also training to simplify cultivation, spraying, and the harvesting of the grape crop.

The time for pruning depends on the season's conditions. The only safe rule is that vineyards may be pruned as soon as the vines are dormant. If pruned too soon, the plants will be weakened and new growth will commence early; then, if a frost visitation is recorded, the young growing shoots will be destroyed, with loss of fruitful shoots. Early pruning will cause the vines to start early in the spring, while late pruning will considerably delay the starting of the buds. Generally, in this State, pruning commences the month of June and is completed by the end of August.

Vine cuttings for propagation may be prepared at any time after vines have become dormant, when cuttings can be selected from the parent plant. They should range from 12 to 18 inches and should always be made from young matured wood and preferably from medium-sized, short jointed wood growths arising from spurs or canes (rods) of previous season's growth. To make cuttings, cut close below the lower bud, the cut to be square across, and leave about an inch of wood above the upper bud or eye.

Illustration No. 1.



Each cutting should have the buds removed from the base end upwards, leaving the top two buds intact for production of growth. The reason for elimination of lower buds is to prevent entrance of dry rot, or any other attack such as white

ants, which may occur from the decomposing of the buds under ground. Soon after the commencement of the rise of sap and following growth, callousing will heal over all cuts, resulting in the trunk under ground being clean and well barked throughout. Cuttings should be tied in convenient-sized bundles, all buds pointing the same way. The bundles should then be buried in trenches with butt end up and covered with about six inches of soil. Inverting the bundles causes the butts to callous while the tops remain dormant, and the cuttings are ready to throw out a rooting system soon after planting in nursery or permanent position. If, on the other hand, they are heeled in with buds upwards, they often commence growth prior to developing root growth to support them.

When the ground has become warm enough, or in the early spring—August,—plant the cuttings in well, deeply worked soil. If in nursery, set each cutting at such a depth that only the upper two buds are just above surface level, spacing them about two to four inches apart with about three feet between rows. When selecting land for propagating cuttings, it is advisable, if possible, to have the sets in a position that can be irrigated with at least three or more waterings during the summer months. Also the soil should be kept well stirred with the hoe and cultivator to keep it mellow and as moist as possible. The principle involved is to create a good rooting and head growth the first year prior to planting in permanent position.

A description of the parts of the vine is necessary before the subject of pruning is considered, as per illustrations Nos. 2, 3, 4, and 5.

No. 2.—Photograph of 10-year-old Gordo Blanco Muscatel grown in the Swan Valley, before pruning.

(1) Main trunk or body of vine.

(2) Crown of vine formed at suitable commercial height for trellising.

(3) Main arms and permanent branches, which are of mature wood of several years old.

(4) Secondary arms which arise from the main arms and permanent branches.

(5) Canes of seasonal growth; when young, called "green shorts."

(6) Laterals which grow from canes in the form of seasonal secondary shoots.

(7) Water shoots which have sprouted from main trunk of vine.

No. 3.—Photograph of No. 2 after pruning.

(1) Main trunk or body of vine.

(2) Crown.

(3) Main arms.

(4) Secondary arms.

(5) Spurs.

The system adopted in the pruning of this vine, Gordo Blanco Muscatel, is termed spur pruning along the main arm or cordon, spurs being pruned to one clear bud. Generally growers in the Swan Valley shorten back the spurs to the basal bud with the object of lightening the crop and increasing quality. This variety of vine is a prolific bearer.

Illustration No. 2.

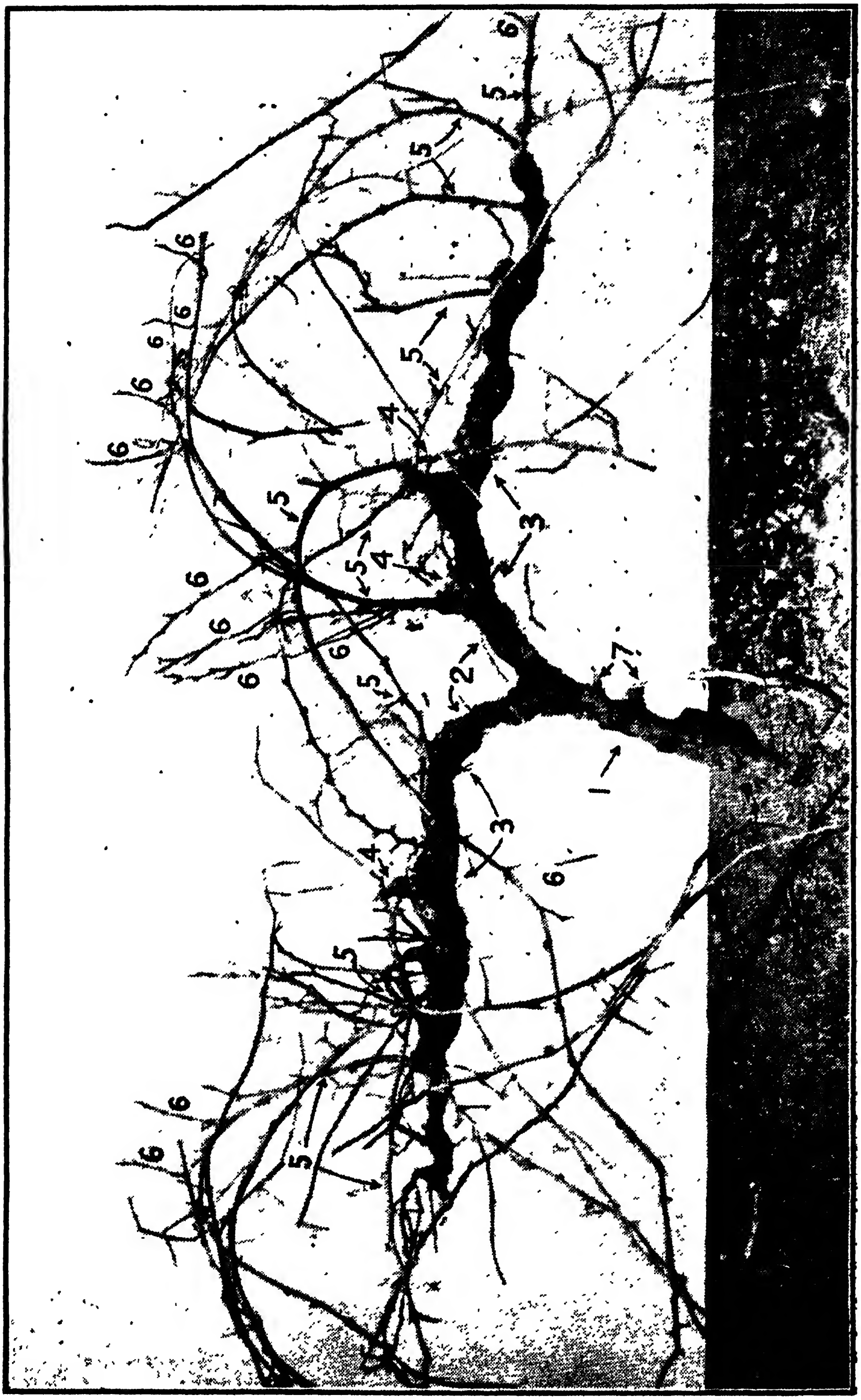


Illustration No. 3.

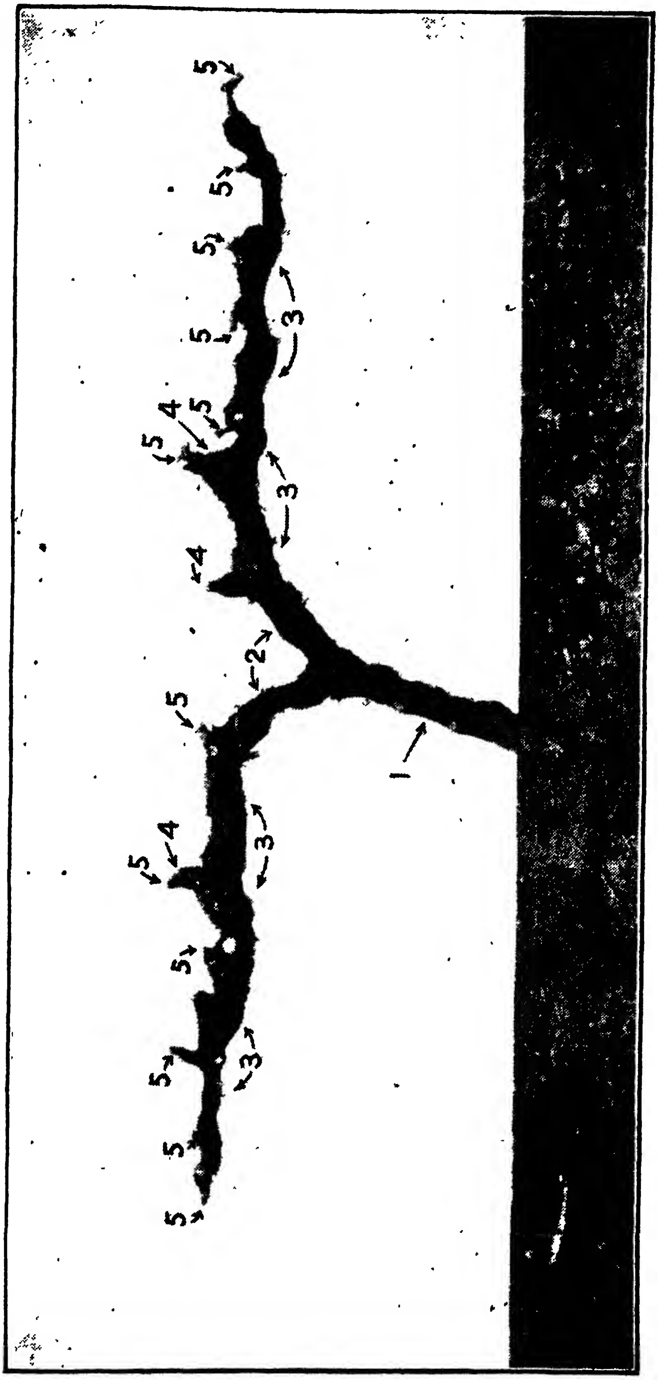


Illustration No. 3A.

No. 3A.—Showing crown, and portion of main arms, with subsidiary arms growing horizontally from main arms which carried the fruiting spurs, and is pruned to two distinct eyes on each fruiting spur. The variety of vine is Zante Currant.

Illustration No. 4.

No. 4.—Shows water shoots growing from main stem or body of vine. These should be pruned closely by the pruner, as shown in illustration No. 3.

Illustration No. 5.

No. 5.—Suckers which shoot from under the ground. The earth should be removed and the suckers cleanly removed by the pruner, as they are of no value, and, if allowed to exist, would rob the general growth of the parent stock.

Illustration No. 6.

No. 6.—This is a sketch of a grape vine after one year's growth in nursery, and the markings indicate the pruning of roots before planting, also pruning of top portion of vine to two distinct buds. Usually no training is given the first year after planting in a permanent position.

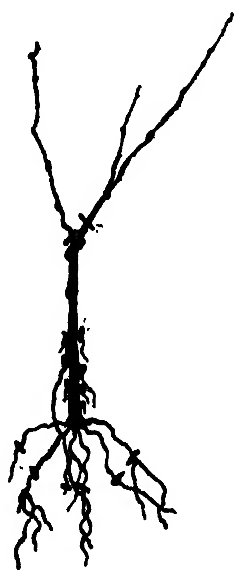
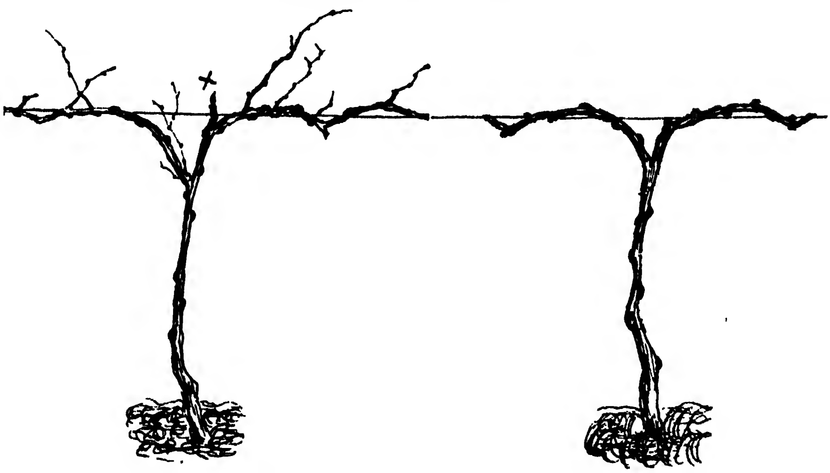


Illustration No. 7.

No. 7.—A vine pruned after the first year in the vineyard. The most upright growth is selected and pruned to two distinct buds.

Illustrations Nos. 8 and 9.



No. 8.—This shows the growth of the vine following pruning, as in illustration No. 7. Although the vine in No. 7 was pruned to two distinct buds, only one was allowed to grow; all other young shoots have been removed during early growth, preferably when not more than six inches long. This concentrates all the force of growth of the plant into the cane which is to become the main trunk or body of the vine. Care must be taken to stake and tie the growth until it reaches the required height for formation of crown. This care is necessary as a protection against winds, and is also essential for straightness of the main trunk. When the shoot has grown to about nine to ten inches above the height required for formation of crown of vine, the terminal growth should be pinched as marked "X" in illustration (No. 8). This treatment will cause laterals to grow where desired to form main arms for shaping and construction for the following season, as will be noticed in illustration No. 9, showing same vine after pruning.

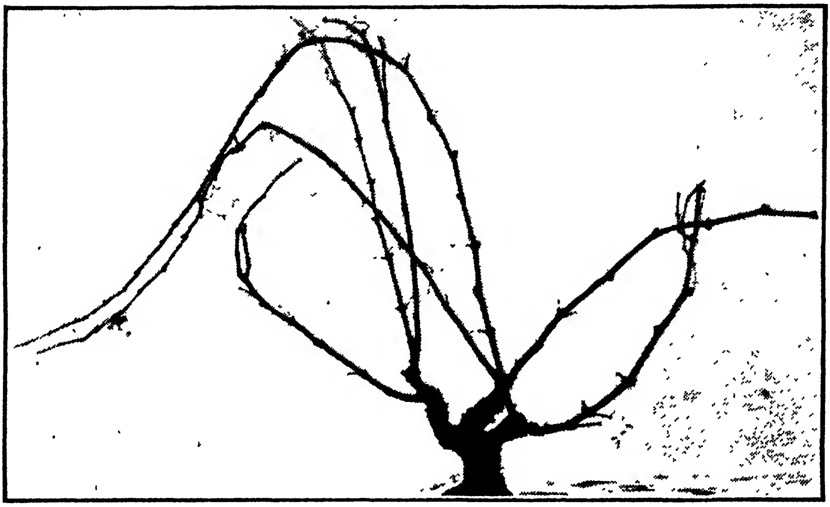
Root Treatment.—A number of roots grow on many vine horizontals from the main trunk of vine just under the surface, while others grow deeper and of a straight downward growth. Those roots which stay near the surface of the soil

will sooner or later suffer during a long spell of hot weather, as the vine during that period has a very heavy task to perform, that is, to propagate growth in foliage and wood, also mature and ripen the fruit. Therefore it is necessary that during the second and third year all young planted vines should have the plant dug round to a depth of not less than six inches and all roots which have developed from the main trunk of vine to depth mentioned should be cut off close to the main stem. This will help to stabilise and develop the lower rooting system, and facilitate deep cultivation, which is necessary for the first ploughing during the winter months, without injury to the vine. It is essential that young vines should be properly cared for during their period of training and formation, as the early years of growth and treatment given the vines during that term largely determine the profit and good working to be derived from them.

There are two distinct methods of pruning—spur and rod pruning—and the two methods are applied individually or in combination, according to the habit of the growth of the vine. A rule that is to be remembered is that all vines bear fruit on the new wood, but, with most varieties, bearing wood only grows from wood of the previous year's growth. Vigorous growths sometimes grow from the old wood or main arms of the vine, and are called "water shoots," and do not produce grapes in the first season, so it is a safe rule for an amateur pruner to cut water shoots away. They should only be left in case of improving the shape of the vine. Some vines produce the fruit-bearing buds at the base of their canes, whilst in the vigorous growing varieties their fruit-bearing buds are situated well along the canes; therefore we find it necessary to spur prune and rod prune.

In pruning, selected fruit-bearing canes are cut back to spurs and rods. A spur is cut back generally to two clear buds, but the number of spurs to be left on each vine is to the judgment of the pruner, as he has to consider the variety and vigour of the plant. Spurs should be from four inches to eight inches apart, the strongest and most matured canes to be used, and on no account leave a cluster of spurs. In leaving too many spurs, the vines may bear too many and too small grapes. To find the medium between these extremes is always a great object and study to which the grower should devote his attention. If more than two eyes are left, the lower eyes may not develop, and the only thing attained by such pruning is to increase the size of the head and length of secondary arms, and thus place the leaves and grapes farther away from the main centre of the vine; also the vine and grapes will suffer damage from the implements during cultivation. In pruning the spurs, the cut should be made about midway along the internode, or well above the second bud, and not so close to it that it will be injured and dry out. A rod is actually a fruit-bearing cane cut back, leaving six buds upwards to one dozen to be suppressed the following year and a replacement to be laid down where vines grow strong and vigorous, and the variety is one that produces its fruit-bearing buds well along the canes. More wood is to be left, but there is a danger or at least a disadvantage in pruning either too short or too long, and in leaving too many spurs or rods. On leaving too many eyes, the shape of the vine is changed and becomes elongated, or even seriously injured. Definite direction of pruning cannot be applied to every locality or to every vine, as soils, variety, and climate are not all alike; therefore the methods of pruning have to be modified.

Illustration No 10.



No. 10.—Vine before pruning, trained under the Goblet, or otherwise known as the Gooseberry-bush system. It is the simplest and cheapest method of pruning and training vines, and is in vogue in most commercial wine-growing vineyards, and the method also facilitates cultivation. An ordinary vine at about five years old consists of a trunk from which spring four or five arms; arising from them are the spurs from which the canes grow and carry the fruit.

Illustration No. 11.

No. 11.—The same vine pruned to the Basket-handle system, which embodies the spur and rod pruning in combination. The rods are interwoven; the principle involved is the rods to carry the fruit for the ensuing season, and at the next pruning season they are suppressed by the pruner and replaced by canes or rods growth arising from the spurs.

Illustration No. 12.

No. 12.—Vine pruned to the Goblet or Gooseberry-bush system. The spurs of last season are cut off just outside the inner canes, which in turn are cut back to spurs, carrying two distinct eyes or buds. The pruning each winter is to create a promotion of a regular system of spur renewal. As the vine becomes older and more vigorous, it will stand more cropping, and then more spurs are left to increase the yielding capacity of the vine. The head of the vine should be kept well balanced in shape, and as time elapses the arms of the respective spurs are renewed, and new arms and spurs are grown.

(To be continued.)

COW PEAS.

(Dolichos sinensis.)

G. K. BARON-HAY, Superintendent of Dairying.

In view of the particularly unfavourable season now being experienced, mitigating against the rapid growth of pasture, it is almost certain that the quantity of herbage cut and conserved as silage this season will be inadequate for the requirements of dairy stock.

The special value of subterranean clover silage has been that this food is succulent and, moreover, is a high protein-containing fodder. This latter quality is not possessed by the plants usually grown as summer fodders, such as maize, sudan grass, sorghums, etc. The special need is therefore for a summer-growing legume, and the writer believes that of various plants tried out during the last few years in this State, cow peas are by far the most promising.

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The cow pea, which is in reality a bean, is indigenous to tropical regions and has been cultivated in Africa and Asia for human food for many centuries. It is now commonly grown for soiling, pasturage, green feed, hay and ensilage for feeding to all kinds of stock, and as a soil improving crop. The seed can be utilised for human or stock food.

Climate and Soil.

Under suitable climatic conditions, which are somewhat similar to those required for the growing of maize, heavy yields of succulent fodder can be obtained

and grazed or preferably used in conjunction with maize, sorghum, or elephant grass as a green feed.

Being of tropical origin, cow peas thrive best under warm moist conditions, and at no stage of growth are they resistant to frosts or extreme cold weather. However, growth will continue throughout the summer until checked by the approach of winter. They are more drought resistant than maize, provided the ground is in good condition and the soil well cultivated between the rows.

Cow peas, like most crops, do best on good soils, but are not exacting as regards the soil conditions and will thrive on practically all classes of summer moist soils or ground where irrigation water can be supplied, but for success it is essential that the soil be well drained and the land thoroughly prepared. Generally speaking, cow peas do not produce an abundance of green material on the poorer soils but tend to produce heavier yields of seed. When grown for green forage, therefore, a previous application of farmyard manure greatly increases the weight of the resultant crop.

Preparation of Land.

If it is intended to grow cow peas alone, the soil should be prepared in a similar manner to that adopted for maize, namely, by ploughing to a depth of not less than 5 inches, and if possible, the area should be fallowed in the autumn and re-ploughed in the spring. After ploughing, the land should be brought to a fine tilth by the use of disc harrows, roller, and ordinary spike harrows. No difficulty will be experienced in obtaining a good stand if the seed bed is fine, moist and warm.

Planting.

The time of planting depends on the climate of the district in which the crop is to be grown. Planting must be delayed until all danger of frost is over, and the soil must be warm so as to obtain a rapid even germination. With too early planting the seed is likely to lie in the ground and rot, or if germination takes place it will be slow and give unsatisfactory growth.

October is early enough for planting in our main dairy belt, but planting may be continued well into December.

Rate of Seeding.

The seed may be broadcast at the rate of 30 to 60 lbs. per acre depending on the variety, but—for preference and economy—drilling is strongly advocated. When drilled in rows 3 feet apart, the rate of seeding will vary from 7 to 15 lb. per acre according to the size of the seed and variety. Sown in this manner the Black Seeded variety, which is recommended, will require 7 lbs. of seed per acre. The depth to sow the seed is from 2 to 3 inches as usually employed for maize.

Manuring.

Being a legume, the principal fertiliser required is superphosphate, providing that the necessary nitrogen-fixing bacteria are present. When planting, a small quantity of sulphate of ammonia is desirable, as the young plants will not have sufficient bacteria on their roots to supply nitrogen from the air. The mixture recommended is not less than 2 cwts. of superphosphate and 56 lb. of sulphate of ammonia per acre. Generally an application of 3 cwts. per acre of "Super and Ammonia No. 2" will supply the fertilising ingredients required.

Inoculation.

Cow peas, like other legumes, can obtain their nitrogen requirements from the free nitrogen of the air, which is fixed and made available to them by nitrogen-fixing bacteria. Inoculation, therefore, with the desirable specie of bacteria is essential, and cow peas cannot be a complete success without it.

"Cultures" for cow peas are being prepared in the laboratories of the Plant Pathologist of the Department, and applications for culture should be made to the Director of Agriculture, and accompanied by a fee of 1s. 6d.; this being sufficient to treat 40 to 60 lbs. of peas.

Cultivation After Planting.

Much of the success of the crop will depend on frequent cultivation to conserve the soil moisture and keep down weeds. The cultivations begin soon after germination commences and continues until the spread of the plant prevents further working, which is usually 5 to 6 weeks from date of planting.

Cow Peas and Maize grown by Mr. S. F. Russell, Serpentine.
Photo. taken 10 weeks after planting.

Growing in Conjunction with Maize.

One of the best ways to use the crop for fodder purposes is to grow the cow peas in combination with maize. Mr. S. F. Russell, of Serpentine, has demonstrated very successfully that yields up to 33 tons of green material per acre can be obtained from maize and cow peas. The accompanying illustration shows a crop ten weeks after planting. Sorghum also can be used in place of maize, and the rate of seeding for rows 3 feet apart would be 18 to 20 lb. maize or 10 lb. sorghum with 8 to 12 lb. cow peas per acre. Cow pea seeds may be sown in the same rows as maize, but it is believed preferable to sow in separate rows. The rate of growth of cow peas and maize is approximately the same, so that the alternate rows can be cut together, the mixture providing a succulent and high protein ration for milk production.

ARMILLARIA ROOT ROT OF FRUIT TREES. *

H. A. PITTMAN, B.Sc.Agr., Plant Pathologist.

Armillaria mellea, a fungus of world wide distribution, is by far the most important cause of root rot of fruit trees in this State. It is distributed right throughout the orchard areas, citrus trees being particularly affected, though it is found also on stone fruits, apples, pears, grapes, mulberries, passion fruit, and occasionally even potatoes.

Fig. 1.—*Armillaria mellea* fruiting at the base of an orange tree which had been killed by the fungus.

After W. M. Carne, this "Journal," Sept., 1926.

The fungus is commonly present on the roots of native trees, and is especially prevalent in the red gum and jarrah country. It is rarely, if ever, of any consequence in orchards where grubbing-out of the roots and stumps has been efficiently done before planting the young trees, as it most often gains entrance to the living roots from decaying roots or other plant parts remaining buried in the soil after clearing.

SYMPTOMS SHOWN BY AFFECTED PLANTS.

The first indication of Armillaria root rot is a sickly yellow colour in the foliage and a tendency for the trees to become sluggish and to die back. If the soil is removed and the roots exposed it will be found that some at least of the roots

* Revised and reprinted after the article "Root Rot of Fruit Trees due to *Armillaria mellea*," by W. M. Carne, late Botanist and Plant Pathologist to this Department, which appeared in the September, 1926, issue of this "Journal," pp. 429-432, owing to the Leaflet (No. 192) embodying the matter of Mr. Carne's article now being out of print.

will be rotting to a jelly-like consistency. Black strands will be found running among the affected roots, half embedded in the tissues in the case of citrus, and running free on the surface in apples and stone fruit. The presence of these black strands (*rhizomorphs*) on the roots is a certain guide to the identification of the disease. If the bark of the affected roots, which becomes soft and loose, is removed, a layer of white fungal growth will be found between it and the wood. Rotting spreads to the butts of the roots and up the lower parts of the trunks. In an advanced stage of the disease clusters of mushroom-like bodies may be found, in the autumn and winter, at the base of the stem or where a root has been brought close to the surface of the ground. These are the fruiting bodies of the fungus. They are yellowish or brown above and whitish on the underside of the cap. The caps may be from one to over six inches across.

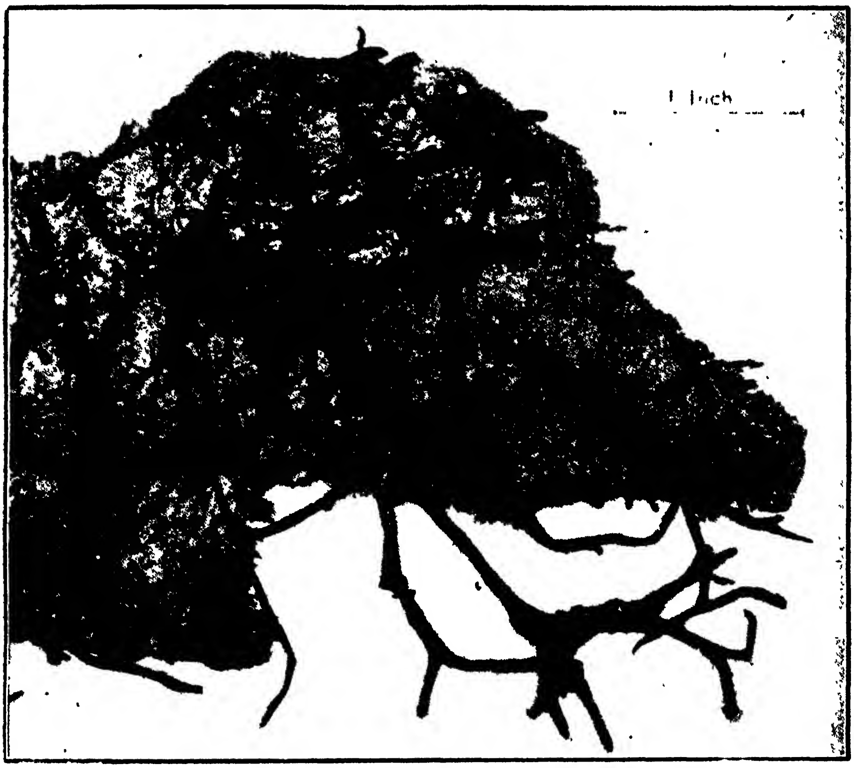


Fig. 2.—Rhizomorphs of *Armillaria mellea* on nectarine root.

Photo., N.S.W. Dept. of Agric.

The fungus causes a rotting of the roots so that the tree suffers from want of food. This leads to yellowing of the leaves, dropping of the leaves, and dying back of the branches. Frequently only the roots on one side are affected, and the tree may live for years. In bad cases most of the roots are affected, and the rot spreads to the base of the stems, working round until the trees are ringbarked. Death occurs usually in the dry season.

CONFUSION OF ARMILLARIA ROOT ROT AND COLLAR ROT.

Root Rot and Collar Rot are often confused. Collar Rot normally develops above the union of stock and scion, and does not extend down to the roots. No *rhizomorphs* are developed. Root Rot, on the other hand, starts with the roots and spreads up the stem from below ground.

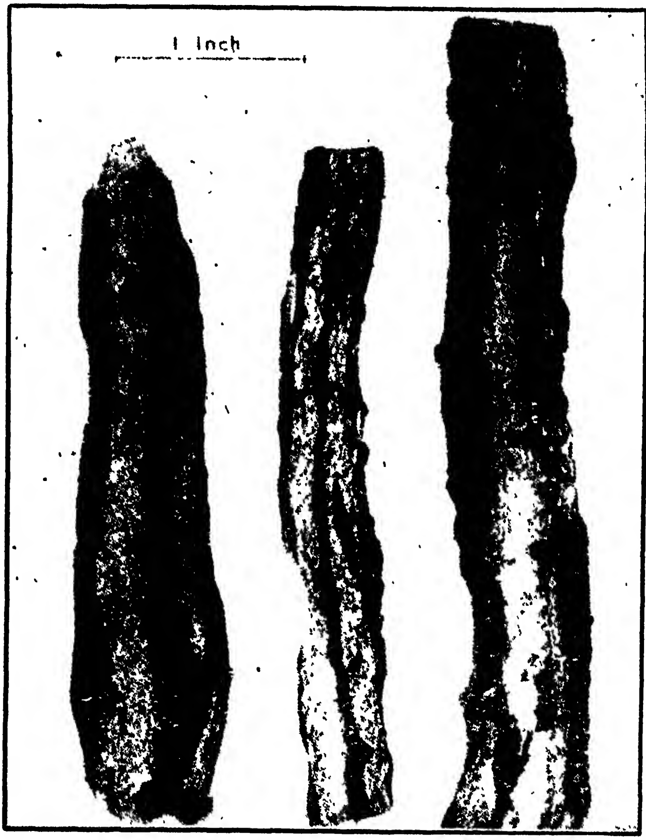


Fig 3.—Rhizomorphs of *Armillaria mellea* on citrus roots.
Photo., N.S.W. Dept. of Agric.

Collar Rot is only of serious moment on soils which remain very wet for a considerable period, as, for example, after rains or irrigation, or as a result of the rise of flood waters or seepage from springs, etc. *Armillaria* may cause serious damage under soil conditions too dry to encourage Collar Rot.

METHODS OF INFECTION.

The principal and most important source of infection is the presence in the soil of roots or stumps of native trees, particularly the marri or red gum (*Eucalyptus calophylla*). This tree has its roots commonly affected with the parasite, which has no apparent bad effect upon its growth. Infection is most likely where land is planted from which green marri has been recently cleared. Wattles are also very liable to attack and suffer considerably.

In addition to the above-mentioned method of infection, the spores or seed bodies of the mushroom-like stage of the fungus may be blown to other trees and start infection.

Once a tree is attacked, the black strands (*rhizomorphs*) gradually work through the soil to the roots of other trees, and in the course of time a large number of trees may become infected from a single neglected diseased tree.

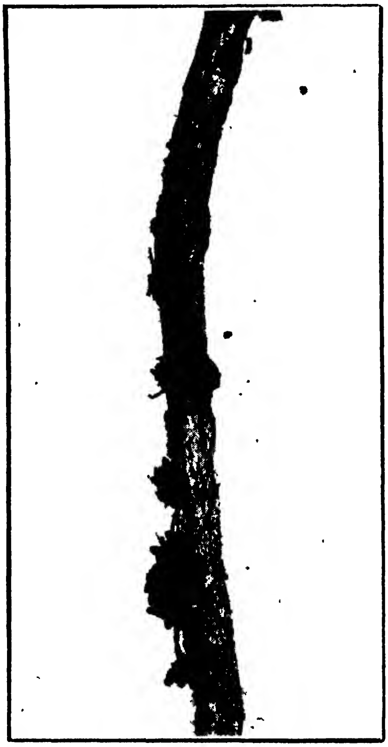


Fig. 4.—Rhizomorphs and young fruiting bodies of *Armillaria mellea* on Orange root.

After W. M. Carne, this "Journal," Sept, 1926.

PREVENTION AND TREATMENT.

1. As in all cases of disease, prevention is better than cure. Armillaria Root Rot in the majority of cases indicates rushed planting in improperly prepared land. It means that stumps have not been properly grubbed out or the roots followed up. Therefore, when clearing, make every effort to remove as many stumps, roots and branches of the native timber as possible from the soil so as to prevent subsequent attack.

2. If possible, grow vegetables (other than potatoes) or cereals for several years after clearing, so that any roots, etc., left may decay thoroughly before the orchard is planted.

3. See that the drainage is satisfactory, as bad drainage aids the fungus. Do not use bush drains, however, as these may harbour the fungus.

4. If a tree should become attacked in spite of all the previous precautions, or because of lack of them, carefully remove the soil from around the trunk so as to expose the main roots. Cut off affected roots, follow them up and remove completely. Then burn them.

5. Now cut away any rotted areas on the stem or butts of the roots, going well into the healthy wood both below, and all round, the diseased area. Then dust the wounded parts with sulphate of iron, or, better still, paint with ***Bordeaux Paste***, made up as follows:—

Dissolve one and one-half pounds (1½ lbs.) bluestone in one (1) gallon of water. Slake three pounds (3 lbs.) of quicklime with another gallon of water. Then pour together and stir thoroughly before using. Apply with a brush as soon after the wound is made as possible.

When not in use the mixture should be kept in a closed container.

6. Then scoop the earth at the base of the tree into a saucer-shaped depression, about three feet in *radius* and pour in a solution of sulphate of iron made up at the rate of one pound of sulphate of iron to five gallons of water. Fifteen to twenty gallons (*i.e.* 3 to 4 lbs. sulphate of iron) will be required, according to the size of the trees, and the treatment is best given in the autumn or spring although it may be successfully used at other times also, provided the trees are not suffering from lack of moisture. When the water has soaked into the soil fill in the depression, *except for a hole, a foot or more in radius and nine inches or so in depth, around the trunk.* The tree should thus be left suspended on the butts of the main roots under and about which air should be free to circulate. This depression should be left open indefinitely to allow plenty of air and light to get at the base of the tree, as the *Armillaria* fungus shuns light and air.

7. To assist the free penetration of light and air to the base of the tree, any very low-hanging branches on citrus trees should be cut back to two feet or so from the ground. (The tops of affected trees may also often be thinned out to advantage.)

The measures numbered 6 and 7 will prevent attack of the trunk, which is the most vital part of the tree. If the trunk and butts of the roots are preserved in a state of health, new roots can be formed from time to time to replace any which may be killed off by *Armillaria*, but a tree cannot form a new trunk.

8. Sprinkle three or four pounds (lbs.) of powdered sulphate of iron around that area of ground beneath, and a yard or so beyond, the spread of the branches, which has not been treated by the watering-in method already described, and either water it in or apply it just before rain, so that it will be readily dissolved and carried down to the roots.

9. Dust any *Armillaria* mushrooms lightly with sulphate of iron as soon as noticed, so as to kill them, and prevent the dissemination of the fungal seeds far and wide.

10. It may be possible at times to inarch one or more young trees into an old one which has been operated on, so as to keep up the flow of sap to the top of the tree, although this is usually more practicable in the case of Collar Rot or brown-rot gummosis, than in the case of Armillaria Root Rot.

11. It has often been recommended that the affected area of ground should be isolated, to prevent the spreading of the fungal *rhizomorphs* through the soil to healthy trees, by digging a trench two feet deep round the outermost limits of the infected zone. The trench should either be left open indefinitely or the soil within the trench should be repeatedly turned over and exposed to the sun. Such a procedure has not usually been found necessary in this State provided that the other recommendations have been satisfactorily carried out.

12. Trees treated as above have often completely recovered and continued to yield heavy crops for many years. If too far gone before the trouble is diagnosed, however, it is best to dig them up, burn them on the spot and treat the holes well with sulphate of iron, as recommended above, before other trees are planted, preferably also leaving the holes open for a considerable time before replanting. If the original stump or root from which infection started can be located this also should be dug out and burnt.

THE WILD TURNIP.

(*Brassica Tournefortii*, Gouan.)

By C. A. GARDNER, Government Botanist;

WITH NOTES ON CULTURAL METHODS OF CONTROL,

By G. L. THROSSELL.

Weeds play a not inconsiderable part amongst the many burdens which the farmer has to bear, but of all the weeds which have proved most troublesome it is doubtful if any single species has proved so serious to the farmers of Western Australia as the wild turnip. Once it has become established on a farmer's holding much patience and labour are required in order to secure its eradication, and such results are rare. Much of the trouble can be traced to indifference in the early stages of the weed's aggressiveness, and the wild turnip, of all weeds, calls for prompt action and unceasing watchfulness. Like many of our weeds the wild turnip had small beginnings, escaping general notice until it had assumed such proportions that it became a menace, but had due care been exercised it is probable that an active campaign six or seven years ago would have either accounted for its extinction, or at least confined the pest to the original centre of its spread. That this is not the case can be traced to a great extent to ignorance and carelessness—ignorance in not recognising in the plant a serious weed, and carelessness in allowing it to spread so rapidly from centre to centre. Speaking of the present extent of the weed's distribution in Western Australia it is doubtful if any other plant has spread so rapidly with the single exception of the double-gee.

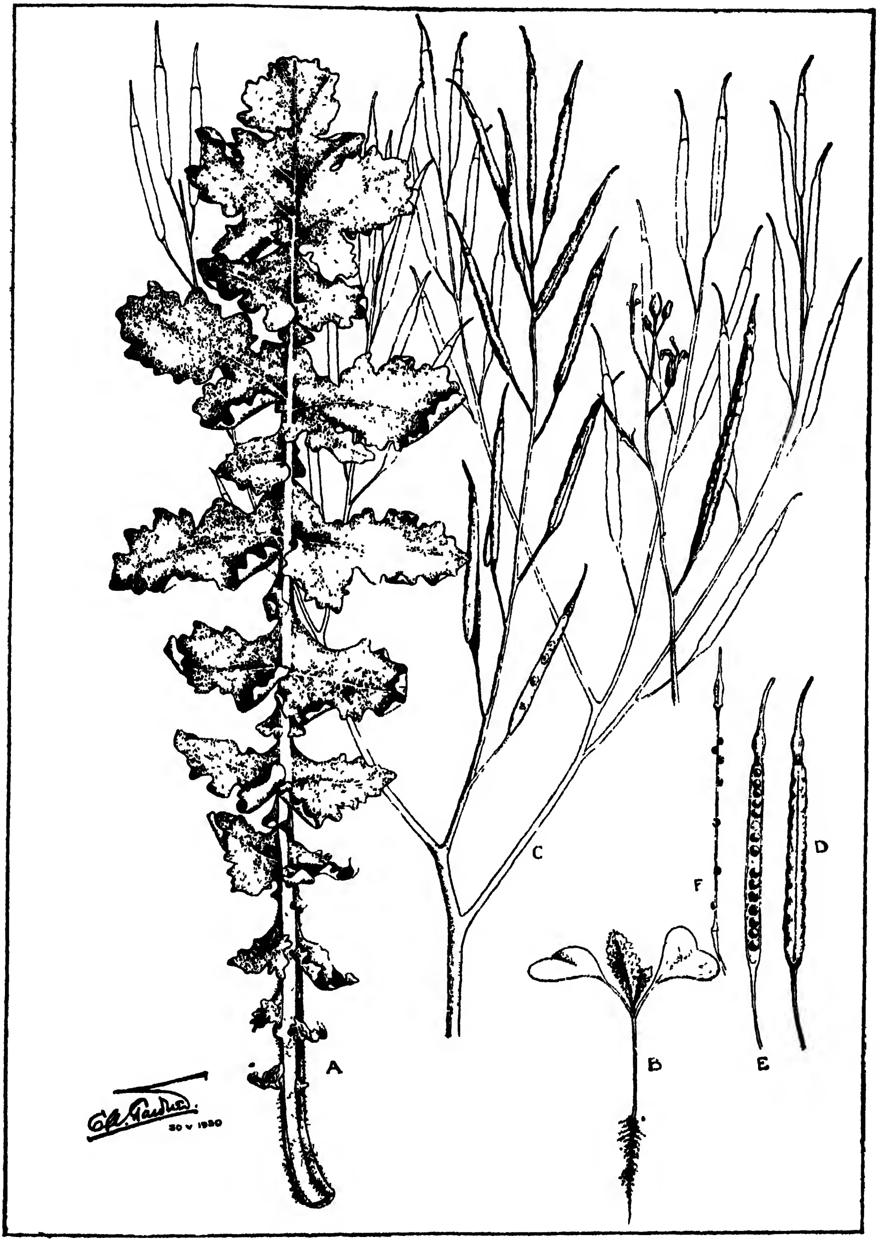
The purpose of this paper, in which the plant is described, together with a summary of its most objectionable features and methods of control and eradication, is the dissemination of what it is hoped will be useful information to farmers who are acquainted with the weed and desire knowledge of how to deal with the pest, and also to inform those who have not seen the plant, of its appearance and characteristics, so that prompt measures can be adopted when, or if, the plant appears in their midst. In fact to the latter class it is of the greater importance, since prevention is better than cure, and there is no reason why the present area of the weed should not be arrested, and even reduced. Care, however, is necessary, and in addition to individual action on the part of farmers it is also desirable in the interests of the community that roads boards and farmers should co-operate in the work of eradition. If the farmer is content to see the weed spread along the road, thinking it the business of the road board to deal with it, and vice versa, and both parties neglect its appearance on Government reserves, it is certain that the weed will become a problem of considerable importance in that district. Wild turnip is not a weed which penalises the untidy or careless farmer alone, for although he may be the principal sufferer he is also contagious, since his neighbours will always be under the necessity of keeping the weed in check. The appearance of wild turnip in an area previously free from the trouble is patently a matter for concerted action by all concerned.

The wild turnip, sometimes referred to as "roly-poly"—but incorrectly so, this name being bestowed on another plant—does not occur in any other State of Australia. We are ignorant as to the circumstances attending its introduction, and the period of this introduction, but it would appear that it first obtained a footing in Australian soil about 1916. It came from abroad, and it is thought by some that the seed was introduced from Argentina during the years

immediately following the drought year of 1914, when seed and produce were imported. Inquiries recently made in Buenos Aires has shown, however, that *Brassica Tournefortii* does not occur in that country to the knowledge of botanists there. Since the species is indigenous to the countries bordering the Mediterranean Sea it appears more probable that the first seeds came from Palestine, Egypt or Tripoli, where it is common. This, however, is a question which cannot be answered to-day.

For about ten years after its introduction the plant made but little progress. It is probable that during this period it was confused with charlock—a weed which is much resembles, or wild radish, and it is significant that the latter was gazetted a noxious weed for the Kellerberrin Roads Board district in 1927 without previous botanical determination; but neither wild radish nor charlock—weeds of long standing—have become so gregarious as wild turnip. The first official recognition of the plant was made in December, 1928, when a complete specimen was received at the Perth herbarium from the manager of the Merredin Experiment Farm. The weed was then stated to be spreading between Hine's Hill and Nangeenan. No reference was made in the available literature to the plant's capacity as a weed, and specimens were sent to the Kew herbarium for substantiation. In reply it was stated that the plant would probably spread extensively if it should find conditions suitable to its growth. This prediction proved correct, and during 1929 complaints regarding the spread of wild turnip were received from the Kellerberrin and Merredin Road Boards, and the plant was gazetted a noxious weed for the State of Western Australia on the 8th December, 1929. The serious nature of the plant was emphasised, and immediate control urged. It was during this season—the end of 1929 and beginning of 1930—that chaff from the affected areas was sent to other districts, and in March, 1930, the plant was collected by G. L. Throssell at Dowak Siding near Salmon Gums. Reports throughout the Salmon Gums district followed early in the winter, and during this same year it appeared on several railway sidings between Merredin and Salmon Gums. By the end of 1930 reports of the presence of the plant were received from districts as far afield as Marvel Loch, Narembeen, Mukinbudin and Koorda. This phenomenal spread must be attributed to the introduction of infected wheat, oats or chaff.

The present range of the wild turnip extends from Carnamah and Coorow in the north to Lake Varley and Lake King in the south; from Koorda and Kellerberrin in the west to the eastern rabbit-proof fence, and a separate centre affected by the weed extends from Widgiemooltha and Norseman through the mallee district as far south as Scaddan. It is worthy of note that the western spread of the weed has been slight except in the north, where in the Coorow district the seed is said to have been introduced through oats. This absence of a noticeable westward drift may be attributed to the absence of introductions of chaff and seed from the east rather than to assumed factors of grazing and unsuitable climate. That the weed will gradually spread westwards unless checked is inevitable, since the prevailing winds favour such a direction. Some centres to the west have, however, been affected, but are controllable. Reports of the presence of wild turnip have been received from Northam, but there are no specimens to confirm this, and it has also been stated that the weed is established on a small area to the south of Cunderdin, but here again the evidence is lacking the support of material. The plant has, however, appeared in the University grounds at Crawley, Perth, being undoubtedly introduced in chaff, but this area, after being subjected to experiment, will be controlled. It is worthy of note in connection with the Crawley specimens that the plants are dwarfed, and lack the vigour in the coastal sand that they possess in the firmer loam of the agricultural areas.



EXPLANATION OF PLATE V.

A. Leaf (half natural size). B. Young plant, showing primary and secondary leaves. C. Illustrating part of an inflorescence, and the general habit of the summit of the plant when in seed. D. Siliqua viewed from the side showing the beak and dorsal nerve of one valve. E. Section showing a siliqua with one valve removed and the seeds in position. F. View showing the ripe siliqua with the valves removed, the central partition with some of the seeds in situ, and the persistent beak. (Icon. origin.)

BOTANICAL DESCRIPTION OF PLANT.

Root annual, long and vertical, extending to 1.5 metres in length (four and a-half feet). Stems .10—2 metres high (4 inches to 6 feet) erect, flexuose, branching from the base, rarely simple, terete, clothed with stout unequal conical hairs in the lower parts, the hairs more slender upwards, all rectangularly spreading or almost recurved, glabrous in the upper parts, green, or often violet-coloured. Basal leaves rosulate, spreading to a diameter of .5 to .6 metres, shortly and widely petiolate, lyrate-pinnatisect, with 4—12 pairs of segments, the terminal segment almost obovate-orbicular in outline, obtuse and obliquely cordate at the base, ± 3-lobed, with intermediate lobes ± produced, otherwise crenate-dentate; lateral lobes gradually decreasing in size from above to below, the upper pairs ovate and crenate-dentate, the lower pairs oblong and entire, all auriculate at the base; stem leaves much smaller than the radical leaves setaceaus-hispid on both sides, especially on the mid-nerve, oblong or linear in outline, acute, entire or denticulate. Racemes contracted at the time of flowering, but elongating in fruit, 10—25-flowered. Pedicels short, 2—6mm. long, almost erect, glabrous or sparsely pubescent. Flowers small. Sepals 3mm. long, ± erect, the outer pair rounded-oblong, the inner sepals oblong-ovate, rather acute, green suffused with a violet-purple, glabrous, or sparsely hairy outside. Petals 5—7mm. long, pale yellow, often violet on the claw, sometimes fading to almost white; the lamina oblong-obovate, slightly narrowed into a claw. Stamens 6, the inner 4.5mm., the outer 2.5mm. long, the anthers oblong. Ovary cylindrical, with 10—22 ovules in a single row in each cell; style 1mm. long; stigma as wide as the style.

Fruit on a rather long pedicel of up to 1 cm. in length or more, erect-spreading, sometimes almost divaricate, 3.5—6.5cm. long, 2.3—3mm. wide cylindrical with swellings and contractions (torulose), terminating in a usually long beak of 7—10mm., usually containing one, but sometimes 2 seeds, the valves of the fruit membranous, sub-emarginate at the apex, greenish-yellow, or sometimes violet-tinted. Seeds globular, 1—1.2mm. diameter, pale purple-brown in colour, the hilum black, alveolate, pendulous, but erect in the beak.

Flowering season, July to November.

The species belong to the Sect. *Brassicotypus*, Dumort, distinguished by the numerous ovules, large siliqua, conical beak as wide as the siliqua at its base, distinct stem which breaks away at maturity, and the 1—2-seeded beak. It differs from *B. oleracea*—"Cabbage," and *B. rapa*—"Turnip," in the stem-leaves not being amplexicaul, and in these respects from *B. campestris* also. From "Charlock" (*Sinapis arvensis*, Linn.—*Brassica sinapistrum*, Boiss.) the plant can be distinguished by the fewer and narrower stem-leaves, smaller flowers, fewer-flowered racemes, larger and wider siliqua which is 1-nerved, not 3—5-nerved as in *Sinapis arvensis*.

Habitat: Mediterranean Region, from Spain and Portugal to Sardinia, Sicily, Algeria, Tripoli, Lower Egypt, Greece, Smyrna, Syria, Palestine, Mesopotamia, Armenia, the Persian Gulf, and Baluchistan (N.W. India).

Brassica is a latin name for the Cabbage (*Brassica oleracea*, L.) used by Cato (De re rustica, 156, 157). *Tournefortii*, after Tournefort, a botanist who lived (1656-1708) before the time of Linnæus.

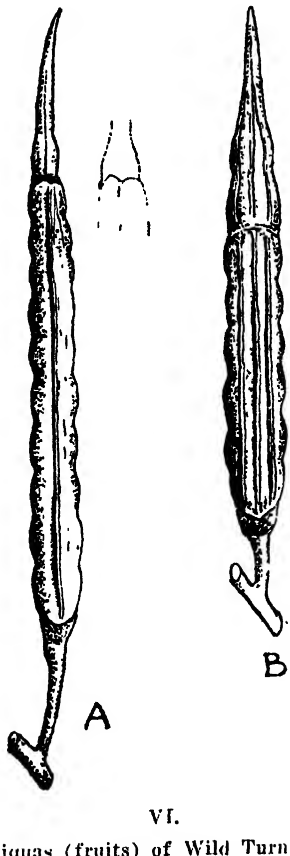
HABIT, AND SOME DISTINGUISHING FEATURES.

The first pair of leaves are small and heart-shaped, with the stalk attached to the apex of the heart. These are succeeded by a number of bristly-hairy leaves, small at first, but soon lengthening, and lying on the soil in a flat rosette, from nine inches to two feet or more in diameter.

In this stage the habit of the plant rather suggests a young cape weed (*Cryptostemma calendulaceum*), but an examination will reveal several differences. The young turnip has bristly-hairy leaves of the same colour on both sides, the leaf is more succulent, and when bruised there is a distinct scent of turnip. The plant is also tap-rooted. The cape weed has soft leaves, hairy on both sides, but more particularly below, where the leaf is grey with close hairs. There are no bristly hairs; the leaf is paler on the under side, and the roots are fibrous and numerous.

Wild turnip is more likely to be confused with wild radish or charlock. In its young state, it is almost impossible to distinguish the plant from charlock, but from the wild radish it can readily be distinguished by the position of the leaves; those of the radish are erect, and do not form a flat rosette.

When the stems are developed the differences are seen at a glance. Cape weed rarely, if ever, has an erect stem, and the stems are woolly-white with reddish, longitudinal lines. The radish stems are leafy, and so are those of charlock, but

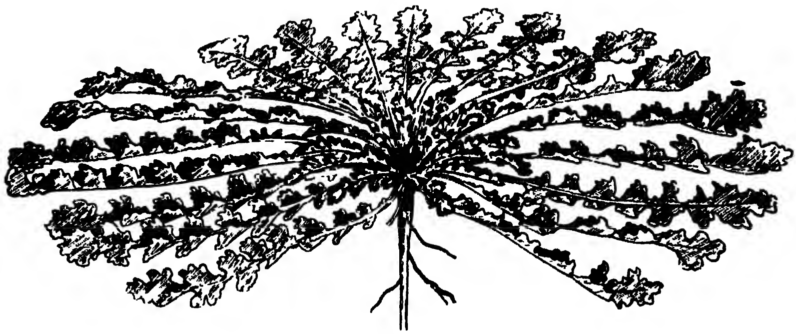


VI.
Siliquas (fruits) of Wild Turnip (A) and Charlock (B).

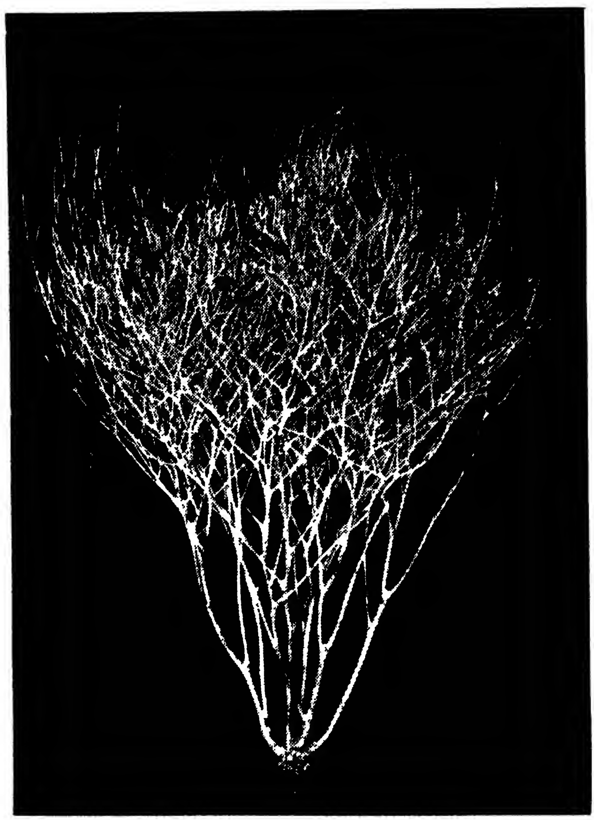
not so leafy as those of the radish. Wild turnip has small stem-leaves, usually few in number, and they are narrow, not coarsely toothed like those of the charlock. The wild radish has stem leaves resembling those of the base of the plant, and they are not hairy, or the hairs are appressed. Rarely are the hairs spreading, and they are not as dense as those of the turnip.

In flower the differences are still greater. The wild radish and charlock have large flowers, those of the former being yellow, white or purplish-pink; those of charlock are a deep yellow. The wild turnip has small flowers of a pale yellow. The charlock has a swollen tap-root, often half exposed, and purplish in colour. It resembles, in short, a small turnip. The wild turnip has a slender tap-root. The

charlock also has more numerous flowers, and there are broad-toothed leaves on the stem. The wild radish has leafy stems also, but the leaves of the stem are not very different to the lower leaves.



II.



III.
Mature plant in seed. In this condition the plants are carried about by wind.

In fruit the three are still more distinct. The fruit (seed-pod) of the wild radish resembles a string of beads, being much narrowed between the seeds, and the fruit does not open, but breaks transversely between the seeds, each segment remaining entire with a seed inside. Charlock and wild turnip shed their seeds. The "pod" of charlock is one to two inches long, on a short stalk, and projects upwards, lying almost against the branch. Each valve (the part which falls off to liberate the seeds) is 3-5-nerved, and rounded at the top. The fruit of the wild turnip is on a longer stalk which projects from the branch at a decided angle, and is one and a-half to three inches long. The "valves" are prominently 1-nerved, with sometimes

IV.

Base of mature plant, showing how the stems separate from the root. Note absence of leaves at this stage.

two fainter nerves, one on each side of the central nerve or rib. The summit of the valves is broad and obtuse, and more or less notched. This character of the nerves of the valves, together with the shape of the stem-leaves, are the most important distinctions to be observed between charlock and wild turnip. The local specimens of charlock have three distinct nerves on each valve. A further distinction is the comparative length of the beak; in charlock this is approximately one-third the length of the fruit, while in the wild turnip the beak is less than one-quarter.

It is not certain whether charlock breaks off at the soil level when mature; the wild radish does not.

Some farmers may possibly confuse the common mustard (*Sisymbrium orientale*) with wild turnip, but the habit is quite different. The stems are leafy with smaller divided leaves, and the small yellow flowers are succeeded by long narrow cylindrical pods with minute numerous seeds. There is no "beak" at the tip of the "pod."

WILD TURNIP AS A WEED.

The characteristics which render the wild turnip so objectionable as a weed are briefly the following:—

The leaves, spreading flat on the ground in a rosette, crowd out or prevent the growth of other plants within their circumference. The area thus covered is often considerable. The characteristic of the breaking away of the stem at maturity renders the plant a mobile instrument of seed dispersal. The large seed production —often some thousands of seeds—makes even a single plant a serious source of infestation. The presence of the beak on the fruit ensures the establishment of new plants wherever the parent plant ultimately rests. This may be a considerable distance from the place wherein it grew. Added to this is the probability of these appendages to the seed vessel being broken off in transit, making the distribution even larger. The longevity of the seeds is another undesirable characteristic. The period of viability is not definitely known, but it is safe to assume that they possess the power to germinate after several years in the soil. The plant is vigorous and thrives in almost all situations. Added to this is the ability of the plant to produce seeds in a short period, even after the stems have been cut down. Short stems may be produced after injury, and these produce a number of fruits in a short time. This is noticeable where the plants have been grazed, where specimens three or four inches in height have produced seeds. The period of flower and seed production is prolonged. Wild turnip may commence seeding within one month after germination, continuing until the late spring. Plants eradicated when in an advanced stage of flowering can ripen their seeds after removal from the soil. The long tap-root enables the plant to thrive in soils too dry for many common weeds, and lastly the fact that the plant is not readily eaten by stock to any extent renders it serious. All of these characteristics make the wild turnip a weed amply provided for, and difficult to abolish after establishment.

AGENCIES FAVOURING DISTRIBUTION.

Although wild turnip is naturally spread through the agency of wind, the dead plants being carried considerable distances along the ground, or even being lifted into the air by strong winds, scattering their seeds in transit, it is not by this means that the plant has made such a phenomenal invasion of our wheat country. Had its spread been limited to natural methods, the area would still be comparatively small. The introduction of the plant from one centre to another has been made almost entirely through wheat, chaff and oats. Seed wheat and chaff were responsible for the distribution of the plant eastwards to the Esperance Railway as far as Dowak, while oats are said to be the means of its introduction into the Midlands areas. The presence of the seeds in chaff was probably responsible for the appearance of wild turnip in the vicinity of railway sidings between Widgiemooltha and Norseman, and quite recently the discovery of the weed in the University grounds at Crawley, Perth, leads one to suppose that the seeds came there in chaff used by horses. It is thus important that farmers purchasing chaff or seed wheat, obtain the former from weed-free areas, and where wheat is purchased from

such areas the grain should be graded, thus eliminating the risk of wild turnip seed contamination. This is also a point in favour of obtaining graded pedigree seed.

Harvesting or reaping machinery borrowed from weed-infested holdings is undoubtedly a source of seed dissemination. Live stock, by ingesting the plants, may also play an important part in this respect. Motor vehicles may also be instrumental in spreading the plant, if they travel through areas of wild turnip. Seeds are probably shed on the running boards or other places, and deposited elsewhere. Cars with portions of the weed adhering to springs, etc., have been noticed.

ERADICATION AND CONTROL.

i.—*Prevention of Wild Turnip in Weed-free Areas or Holdings.*

It is of primary importance that one should be able to recognise wild turnip. Much of the foregoing will be useful in this respect. If any doubt exists, specimens should be submitted for diagnosis. One plant, if left untouched, is sufficient to produce numerous plants in the following season. The recognition of the plant is therefore of the utmost importance. The appearance of wild turnip in a new district should be a matter for concerted action. The plant may first appear on the roadside, and such places are quite as dangerous as cultivated land. It is in the interests of road boards and farmers to deal immediately with the weed upon its first appearance. The plant when it first appears should be pulled up and burned. Due precautions should be observed in connection with the purchase of chaff, seed, and poultry food from unknown sources, and this applies also to the purchase or loan of stock, especially horses from areas where the weed may exist. Borrowed harvesting or reaping machinery should be carefully cleaned before using. Motor vehicles from infested areas should not be permitted the continual use of private roads through a clean holding.

The provision of wind-breaks, or strips of scrub or trees inside the boundary fence is a useful precaution, both in clean areas as well as infested. Scrub provides an effective barrier against an invasion, the turnip plants being heaviest at the base, drive into the scrub and are held there. They can be removed and unless the soil is light, the germination of seeds is small. In any case a watch can be kept over the place where plants are discovered. In addition, such wind-breaks are useful in protecting crops, minimising soil erosion through wind, and providing firewood for the future. Eleven yards is the minimum useful width of such wind-breaks. It should be remembered that a fence, whether wire or netting, is no barrier to the progress of the weed. Finally, keep a watch along roadsides. These are common sources of infestation. Do not leave the matter to the attention of the roads board. When eradicating the plant remember that if seed-vessels are already formed, or even if the plant has matured flowers, it should be destroyed. It is useless to pull out such plants and leave them in situ.

ii.—*Mechanical Methods of Control.*

The plant should be pulled out completely or hoed below the surface of the soil. Young plants may remain on the surface, but mature plants should be collected, and either buried deeply or burned. When collected, such plants should be placed in a bag. Shaking will liberate seeds from mature seed-vessels. It is wise to acquire the habit of recognising the weed in its early stage of growth.

iii.—*Cultural Methods of Control.*

In the summer or autumn preceding fallowing it is a good plan to cultivate the land lightly. This causes the seed to be covered, and a good germination may be produced in readiness for the initial operation of fallow-

ing. Paddocks which are to be fallowed should be stocked heavily. Sheep will do much towards keeping the weed in check, since they eat the plants with avidity when young, provided that other feed is present. Such stocking will also ensure a better turning in of the weeds during fallowing. Land should be fallowed early, before the weeds have made much growth. A minimum depth of 3 to 4 inches is desirable, since it is impossible to do uniform or effective work at a shallower depth. On the heavier classes of soil it is obvious that the lighter types of cultivating ploughs are unsuitable for a thorough initial ploughing. If sufficient sheep are available for grazing and they can keep the weed in check, it may be possible to complete the whole area to be fallowed without the earlier ploughed land receiving further attention. Where this is not the case it is advisable to cultivate a portion of the fallow while the weeds are young, and before the whole area to be fallowed is completed, since greater success is obtained by treating the weeds in the young stage. Fallowed land should be again cultivated during the spring, and should summer or autumn rains produce new growth, harrowing or cultivation should be resorted to.

Where the weed is only occasionally present, hoeing or pulling is the most satisfactory method of dealing with it. It is, however, important that infected spots should be examined during the next year, since ungerminated seeds may be present when the plant is removed.

Infested crops should never be used for hay, since this is a certain way of distributing the plant. Before the cereal is in a stage suitable for cutting, the turnip is certain to be either in seed or in a condition capable of seeding. If clean land is not available, the weed should be eradicated from the hay crop by hand. Since it is unlikely that all plants will be removed by this method, it is wise to watch for plants while reaping. Any plants seen should be removed before being cut.

During harvesting, the attachment of a roller to the machine, either under the comb, or behind, provides a means whereby the stems are flattened out, thus reducing the risk of dissemination by wind.

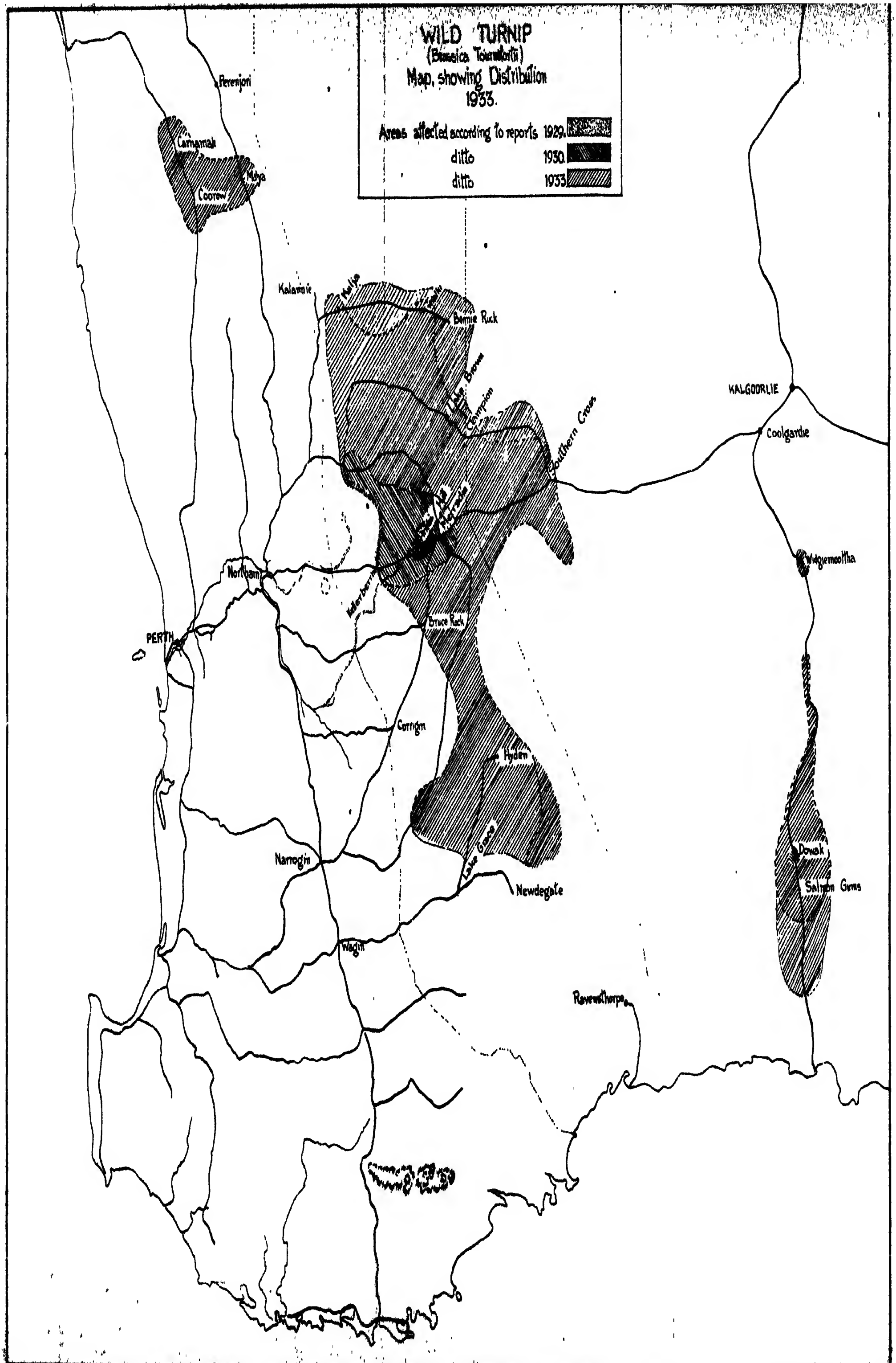
The stubble should afterwards be burned as soon as permitted under the Act. Any plants which have accumulated along fences should also be collected and burned.

Seeding operations should be delayed until after the advent of seeding rains. In paddocks which are badly infested with the weed it is advisable to cultivate after the first rains, delaying seeding operations for at least another week, so that further seeds which may have germinated in the interim can be destroyed when seeding takes place. The cultivation preceding seeding should be deep enough to eradicate the weeds, but not so deep as to destroy the consolidation. Two inches is usually a sufficient depth.*

Cultivated land near fence lines should either be cropped, or eradication should be performed, since the wild turnip usually grows prolifically in such spots. Fence lines are often the resting places for turnip plants in transit.

Badly affected uncropped areas should be rolled and burned. It is dangerous to leave such patches untouched for any lengthy period of time. They are the centres of distribution from which areas are seeded by the weed.

Abandoned farms are a grave source of infestation. A holding on which turnip is present but not controlled remains a menace unless some action is taken towards its destruction. Burning at least, is desirable, since it kills many of the seeds.


WILD TURNIP
(Brassica Tournefortii)
Map, showing Distribution
1933.
Areas affected according to reports 1929.
ditto 1930.
ditto 1933.
Perenjori
Carnamah
Coorow
Kalannie
Bonnie Rock
Lake Brown
Campion
Southern Cross
Merredin
Kellerberrin
Bruce Rock
KALGOORLIE
Coolgardie
Widgiemooltha
Northam
PERTH
Corrigin
Hyden
Lake Grace
Newdegate
Narrogin
Wagin
Ravensthorpe
Dowak
Salmon Gums

CHEMICAL CONTROL.

There are several chemical preparations on the market which probably would be efficacious in destroying wild turnip, but with many of these the cost is prohibitive. Examples are sodium chlorate and calcium chlorate, the cost of which is uneconomical. Experience in England has shown that two sprays are quite positive in action on charlock, these being *sulphuric acid* and *copper sulphate*. The formed was first used is France in 1911 by Rabate, and its use has increased until now several thousand acres are treated annually.

Commercial sulphuric acid (brown oil of vitriol) is mixed with water to give a solution varying from 7 to 10 per cent. in strength, and sprayed over the land by means of a suitable machine with acid resisting parts. From 100 to 150 gallons of liquid is sprayed on to the crop per acre. The best results are obtained when the charlock is in the four-leaf stage, but the treatment is also successful when the plants are several inches in height. The wheat or oat plants of the crop are not affected by this spray. If applied in bright weather the whole field turns brown within an hour of spraying, and in a few days the cereal recovers, and soon presents a healthy appearance.

The cost of the material is cheap, commercial *sulphuric acid* being the same price as bluestone (*copper sulphate*).

The copper sulphate treatment employs a somewhat more dilute mixture, 3 to 5 per cent. of bluestone being used in water, and applied at the rate of 50 gallons per acre. The treatment must be done during fine weather. It is a cheaper method than the *sulphuric acid* method, but is not so popular in Britain because of the necessity of fine weather during, and for several hours after application. Cereal crops are not injured by this treatment.

These practices necessitate the employment of large power sprays, and are not advocated at the present time, since local experiments have not yet been conducted upon wild turnip. It is anticipated, however, that because of the similarity between the two plants, there is every chance of success with such sprays.

BIOLOGICAL CONTROL.

There are no known reliable methods of biological control of wild turnip. Three species of aphids, *Aphis pseudo-brassicae* (stock aphis), *A. brassicae* (cabbage aphis) and *A. persica* (green peach aphis) attack the plant to a greater or less extent, depending upon favourable seasonal conditions. Should they appear in plague form a certain amount of destruction would be accomplished, but as a reliable permanent factor in the control of wild turnip, they cannot be relied upon.

EXPLANATION OF ILLUSTRATIONS.

I.—Map showing the known distribution of Wild Turnip from 1929 to 1933.

II.—Diagram or habit of young plant showing leaf-rosette.

III.—Photograph of mature plant in seed. Note its leafless nature at this stage. In this condition the plant is carried by wind.

IV.—Photograph of basal portion of the plant when mature, showing how the base separates from the root.

V.—Brassica Tournefortii. Showing leaf, flower, head of a branch in seed, structure of siliqua (seed vessel) and young seedling.

VI.—Diagram of the fruits of (A) Wild Turnip, and (B) Charlock. Note the comparatively short and slender beak of the Wild Turnip, the slender stalk, and the one-nerved valves. Notice the long and broad beak of charlock (almost half the length of the fruit), the three-nerved valves, and the short thick stalk.

I.

CITRUS PIT.*

H. A. Pittman, B.Sc.Agr., Plant Pathologist.

This is an old established bacterial disease of citrus which is always with us, but which, in most seasons, is of little importance.

First described by Smith in California in 1913,† it was recognised in South Australia in 1924,‡ and was recorded for the first time for this State in 1926 by Mr. W. M. Carne, late Botanist and Plant Pathologist of this Department, now Senior Plant Pathologist, Commonwealth Council for Scientific and Industrial Research.

Lemon Fruit and Leaf with Citrus Pit
caused by *Pseudomonas citriputeale*.
(After Fawcett, Horne, & Camp.)

Citrus Pit occurs most commonly on lemon fruits, and to a lesser extent on oranges and mandarins. With us, lemon leaves are apparently more frequently attacked than those of oranges or mandarins, though the reverse appears to be

* Revised and reprinted after the article "Citrus Pit," by W. M. Carne, late Botanist and Plant Pathologist to this Department, which appeared in the September, 1926, issue of this "Journal," pp. 378-381, owing to the Leaflet (No. 191) embodying the matter of Mr. Carne's article now being out of print.

† Smith, C. O.—Black Pit of Lemon—Phytopathology III., 1913, pp. 277-281.

‡ Lewcock, H. K.—Prelim. Note on a Citrus Bacteriosis in South Australia—A.A.A. Science XVII., 1926, p. 746.

the case in California.* There the twigs are also affected, and to this and the leaf attack the name Citrus Blast has been given. Twig attack has not been noted here.

On lemon fruits the spots are depressed, dry, circular, angular or oval, reddish-brown, brown or black, from very small up to three-quarters of an inch in diameter. Under wet conditions secondary organisms such as Blue Mould, Dieback (*Colletotrichum gloeosporoides*) and Sour Rot (*Oospora citri aurantii*), may extend

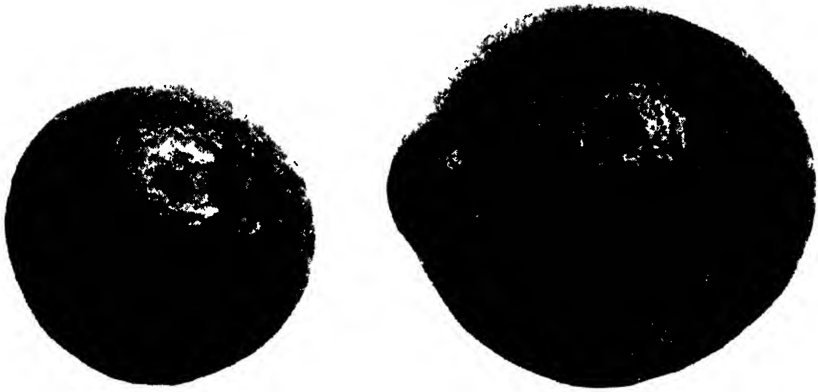


Fig. 1. Lemon Fruits affected with Citrus Pit due to the bacterium *Pseudomonas citriputeale*.
After W. M. Carne, this "Journal," Sept., 1926.

the affected area over one-half the fruit or more, and cause a soft rotting. Under more normal conditions the spots are hardly conspicuous enough to seriously affect the sale of fruit.

On oranges and mandarins the spots are usually reddish-brown and smaller. They may run together, however, and form irregular, dry, brown areas.

The spots are confined to the rind of the fruit, and the edible portions are not affected unless secondary infection follows the primary attack. Indeed it may be said that the disease is only of importance when climatic conditions favour the secondary rotting organisms.

On leaves, infection is indicated by a blackened area, usually on the side or tip but occasionally central. There is a similarity to the leaf trouble caused by Brown Rot, but the edges of the blackened areas are less distinctly defined. The affected areas tend to dry and crack, and the leaves fall readily.

Experiments by Mr. W. M. Carne indicate that infection can be readily obtained when the tissues have been broken by pricking or otherwise injured. His attempts to infect sound fruit failed. This is in conformity with the American experience* that the bacterium is essentially a wound parasite, rarely, if ever, able to penetrate sound tissues. Fresh scratches and rubbings while the fruit is wet, with moderately low temperatures, ensure ready infection. It follows, therefore, that the trouble will be greatest in orchards exposed to much wind during wet winters. The present author has noted that this disease may cause considerable discolouration of the wounds made in citrus fruits by hail storms.

* Fawcett, H. S., Horne, W. T., and Camp, A. F.—Citrus Blast and Black Pit—University of California, Agric. Expt. Stn. of College of Agric. Technical paper 5, 1923, pp. 1-24.

CONTROL.

The trees should be protected from winds by wind-breaks as far as possible and dead wood should be consistently pruned out.

American investigations have shown that bushy compact trees are less liable to wind injury than those of more straggling growth. It has been found in this

Fig. 2.—Orange and lemon with Citrus Pit due to attack by *Pseudomonas citriputeale. After W. M. Carne, this "Journal," Sept.,* 1926.

State that this disease is readily controllable by the routine autumn and early spring sprayings with 4-4-50 home-made Bordeaux mixture for Brown Rot. (See Leaflets Nos. 354 and 314, 2nd edit.)

LIVE STOCK AND MEAT.

For the information of readers of this "Journal," the following particulars have been supplied by Messrs. Elder, Smith, & Co., Ltd., Perth:—

COMPARATIVE NUMBERS OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS FOR MONTHS OF JUNE, JULY, AUGUST, 1933.

—	June.				July.				August.				
	7th.	14th.	21st.	28th.	5th.	12th.	19th.	26th.	2nd.	9th.	16th.	23rd.	30th.
Sheep...	8,768	7,304	11,747	10,397	8,797	11,258	10,263	9,566	10,263	13,184	12,347	12,133	12,182
Cattle...	466	462	429	637	622	543	593	350	452	328	668	529	627
Pigs ...	1,537	1,168	1,575	1,346	1,368	1,510	1,596	1,889	1,440	1,360	1,447	2,204	1,427

COMPARATIVE VALUES PER POUND.

Mutton	4½d.	6d.	4¾d.	4¼d.	4½d.	4¼d.	4½d.	5½d.	5d.	4½d.	4½d.	4¼d.	4½d.
Beef ...	6¼d.	6½d.	6d.	4¾d.	4¼d.	4d.	4d.	5¼d.	5¼d.	5¾d.	5¼d.	4½d.	4d.
Pork ...	6d.	6d.	6d.	6d.	6d.	6d.	6d.	5½d.	5½d.	5¼d.	5½d.	5½d.	5½d.
Bacon...	4½d.	4½d.	4¼d.	4¼d.	4¼d.	4¼d.	4¼d.	4¼d.	4¼d.	4½d.	5d.	5d.	5d.

MARKET REPORT.

Messrs. H. J. Wigmore & Company, Limited, of Wellington Street, Perth, have supplied us with the following information regarding the chaff available for auction at the Perth Railway Yards, for the period June to August inclusive.

June.—720 tons of chaff. F.a.q. to prime wheaten chaff was making from £4 17s. 6d. to £5; f.a.q. from £4 10s. to £4 15s. per ton. Mediums were selling at £4 5s. Prime oaten chaff was changing hands from £4 12s. 6d. to £4 15s.; f.a.q. from £4 7s. 6d. to £4 10s. per ton.

Oats.—Good heavy feeds were finding buyers from 2s. 1d. to 2s. 5d.; good feeds from 1s. 11d. to 2s.; light feeds from 1s. 8d. to 1s. 10d. per bushel.

Wheat.—F.a.q. was selling at 3s. 4½d.; second grade from 2s. 9d. to 2s. 10d. per bushel.

July.—1,015 tons of chaff. The market for both wheaten and oaten chaff remained unaltered.

Oats.—Good heavy feeds were finding buyers from 1s. 11d. to 2s. 1d.; good feeds from 1s. 8d. to 1s. 10d. per bushel.

Wheat.—At the beginning of the month f.a.q. was making 3s. 3½d., second grade 2s. 11d. per bushel, but towards the end of the month the market advanced considerably, f.a.q. found buyers at 3s. 6½d., second grade 3s. 2½d. per bushel.

August.—600 tons of chaff. F.a.q. to prime wheaten chaff was selling at from £5 to £5 5s.; f.a.q. from £4 15s. to £4 17s. 6d. per ton. Prime oaten chaff was in demand at around £4 15s. to £4 17s. 6d.; f.a.q. at £4 12s. 6d. per ton.

Oats.—Good heavy feeds found buyers from 2s. to 2s. 2d.; good feeds from 1s. 9d. to 1s. 10d. per bushel.

Wheat.—F.a.q. was realising from 3s. 1d. to 3s. 4d.; second grade 2s. 11d. per bushel.

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	JUNE, 1933.						JULY, 1933.						AUGUST, 1933.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	67·9	75·2	50·4	42·3	5·64	4·21	64·8	73·3	44·2	38·0	2·57	4·01	67·7	75·5	45·9	39·9	3·86	2·75
Geraldton	70·5	74·2	56·4	45·8	6·23	4·76	67·1	72·5	49·3	41·5	2·57	3·92	69·5	75·4	52·5	46·5	3·85	2·89
Walebing	65·1	75·1	47·5	37·2	5·12	4·01	60·0	67·0	40·7	34·0	2·71	3·80	62·2	70·0	42·0	32·0	3·33	3·12
Perth	65·8	71·2	53·3	43·1	6·52	7·02	62·4	70·8	46·3	37·6	4·99	6·77	63·4	70·8	47·8	38·8	5·67	5·74
Kalamunda	62·2	69·2	52·2	43·5	8·26	8·19	56·1	68·5	44·4	37·9	5·61	8·71	60·7	68·9	45·8	38·1	7·07	6·90
Bunbury	64·9	70·1	53·3	40·0	7·41	7·18	62·2	66·0	46·1	36·0	4·24	6·87	63·1	69·0	45·7	38·4	4·95	5·27
Bridgetown	62·9	68·8	45·9	30·0	10·99	5·92	59·6	67·0	40·1	31·0	5·24	5·81	61·3	69·8	39·4	28·5	5·06	5·10
Albany	62·9	69·0	50·4	42·2	8·79	5·43	60·3	65·8	46·1	38·4	4·80	5·61	61·0	71·3	45·9	37·8	4·97	5·29
Merredin State Farm	63·1	70·3	46·4	34·5	2·13	2·02	59·3	65·9	37·8	28·1	1·28	2·24	61·2	68·1	41·0	32·0	1·51	1·52
Northam	65·8	73·0	47·3	36·4	4·06	3·27	62·4	69·0	39·8	32·0	1·93	3·52	63·6	72·1	42·0	34·2	2·21	2·62
York	65·2	43·0	47·2	36·0	3·01	3·32	61·6	67·0	38·8	29·0	2·04	3·45	63·4	73·0	39·7	32·0	2·12	2·84
Narrogin State Farm	60·3	66·4	47·3	34·3	3·95	3·40	57·0	62·7	40·1	30·0	2·39	3·77	58·6	65·6	40·6	32·0	2·45	2·94
Katanning	60·8	65·0	47·9	35·3	5·43	2·94	57·5	62·0	43·5	35·0	2·07	3·13	58·8	66·6	40·8	30·0	2·43	2·47
Cape Leeuwin ...	64·0	70·0	54·8	46·0	12·44	6·91	61·3	66·8	51·5	42·5	7·87	7·30	60·9	68·8	54·9	43·5	5·35	5·28

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DOG TRAPPING.

G. Herbert,

Wild Dog Trapper appointed by Vermin Advisory Board.

In trapping dogs and foxes it is necessary to remember that this work must be carried out thoroughly and efficiently, if success is to be assured. A dog which has escaped from a carelessly set trap becomes wary or "educated" and develops a cunning which is difficult to overcome. The dog which has not previously had experience of a trap is usually an easy mark for an experienced trapper, but the dog which has escaped from a trap, particularly one which has been held by a trap for some time and possibly injured by losing toes or a portion of the foot, is the animal which becomes a curse and menace to a district.

Trapping has many aspects and must be studied from every angle, not merely to find out what to do, but what to avoid. A brief summary of the details to observe is given hereunder:—

(1) Secure the best type of trap available.

(2) Spend the necessary time to put the trap, as purchased, in perfect working order.

(3) Make sure trap is perfectly clean before setting.

(4) Poison the jaw of the trap thoroughly.

(5) Set the trap carefully and thoroughly.

(6) Avoid setting traps near rabbit warrens, on paths or roads, near waters or places where other animals are likely to interfere with them. (Sprung traps make a dog wary.)

(7) Do not set traps too close to carcases of animals or birds. These attract crows, cats etc. If a carcase is used for a trail, do not leave it too close to trap.

(8) Avoid using meat, fat or oily decoys. Never use chemically prepared decoys where other animals are about; these attract other creatures as well as dogs.

(9) Remove and burn all dog carcases when caught. Although these often prove a useful decoy, they educate some dogs, which become very shy if they find carcases of their mates lying about.

TYPE OF TRAP.

The type of trap found most efficient, and therefore recommended, is the seven-inch drop-plate trap, as illustrated in Fig. 1. Attention is drawn to the fact that there are a number of traps on the market inferior both in quality and design. Obtain the best quality trap obtainable, of the drop-plate type.

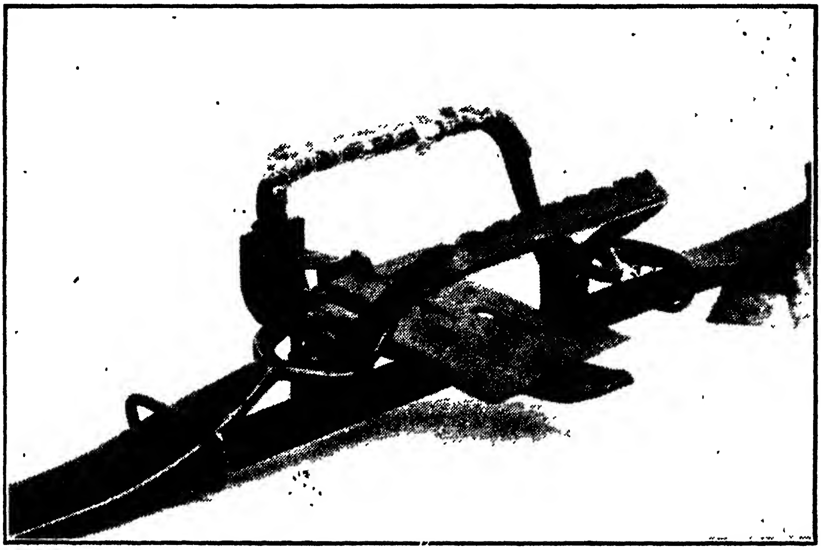


Fig. 1.—Showing teeth of jaws cut off, leaving last tooth nearest the spring as a short stub to prevent jaws meeting closely.

METHOD OF TRAPPING.

The method of trapping described in this article is called the "decoy method," that is, placing a decoy such as dog manure or other preparation in a selected spot, and placing a trap before it in such a manner that the dog, when approaching the decoy to smell it, treads on the trap, and in setting it off, is caught. This is the most satisfactory method of securing a dog with the trap. It also has the added advantage of avoiding, to a great extent, the trapping of other creatures, which are not wanted. The method known as "chance trapping" is not recommended. Chance, or "blind" trapping, is merely burying a trap on a path or in the bed of a creek, or along tracks and roads for the dog to tread on by accident. This method helps to educate dogs. A dog may easily tread on the jaw of the trap so set, or on the looped end of the spring between the ends of the jaws, and touching the edge of the plate with his toes or claws. When the trap is sprung, the jaw of the trap, or spring (as the case may be), will force his foot up and merely "nip" his toes, or force the foot clear, thus educating without securing him. It also leaves the trap unprotected from other animals or passing traffic. Some time ago, whilst driving a car along a bush track, twenty-two traps were sprung in half a mile. The trapper in this case not only had his work for nothing, but left his traps open to possible damage, and also, in the event of a dog or fox coming along shortly after, gave it an excellent education. This method of "chance" trapping is not recommended and should be avoided.

ADJUSTING THE TRAP.

There are a few adjustments to be made to the trap, as purchased, in order to make it more efficient. These are all simple, and only require to be checked up occasionally to keep the trap up to the standard required. Settlers frequently ask why any adjustments should be necessary, or advisable, and are advised that makers send out a standard type trap, which is not as efficient as it can be made by men who have spent years of their lives in the practical work of trapping dogs, and have discovered little points which ensure success.

An improved type of trap has been patented but has not been placed on the market as no firm could be induced to spend the money involved in its manufacture. It is a pity that this should be the case, as traps are in constant demand and it is believed these would sell readily. This being the position, trappers must make what adjustments are found necessary to the type of trap obtainable on the market.

First, remove the jaws by clamping down the springs with the loops or clips provided for the purpose, and lever jaws out. Cut off the teeth with a cold chisel (an old axe will do), but leaving a small stump of tooth at each end of the jaw, as shown in illustration (Fig. 1). When the jaws are replaced, and the trap closed, the stumps of the teeth should hold the jaws about quarter of an inch apart, as shown by the irregular black line in Fig. 2.

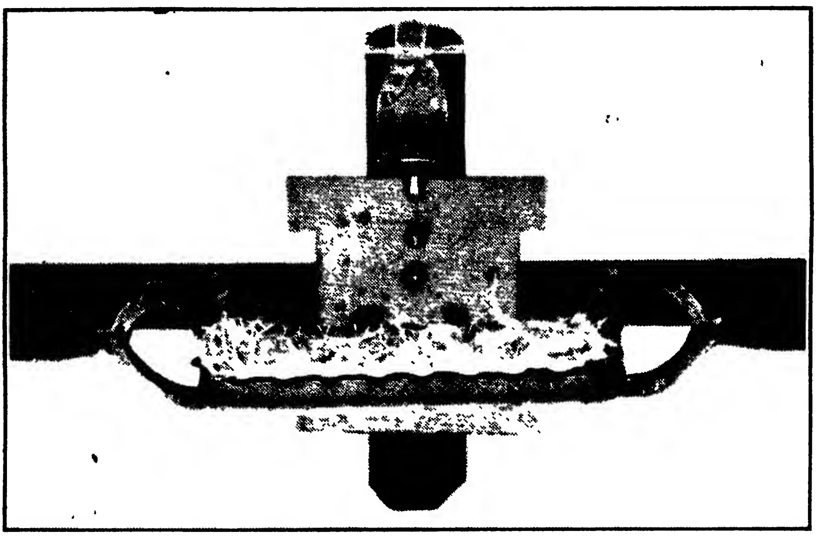


Fig. 2.—The irregular black line shows gap about ¼in. wide between jaws formed as result of cutting off points of all teeth except end teeth nearest springs, which prevents jaws meeting closely.

The sharp teeth originally provided often very quickly cut off the dog's leg. With the teeth removed, and the gap left between the jaws, the sinews of the leg will hold for a long time, even if the leg is broken.

Unless the trap as purchased provides for the following, it must be adjusted so that—

(a) the jaws work freely up and down;

(b) provision is made for only a short drop of plate before going off;

(c) the plate of the trap will carry a weight of two pounds on its centre without going off;

(d) the free or back edge of the plate is about 2 inches from the bottom cross bar when the trap is set.

With regard to (a), the jaws should be free to move up and down when the springs are clamped down, but should have no end play, otherwise they may spring out of place when the trap is set off. The jaws are soft steel and easily hammered into the required shape.

A sketch of the plate with the catch as when purchased is shown in Fig. 3.

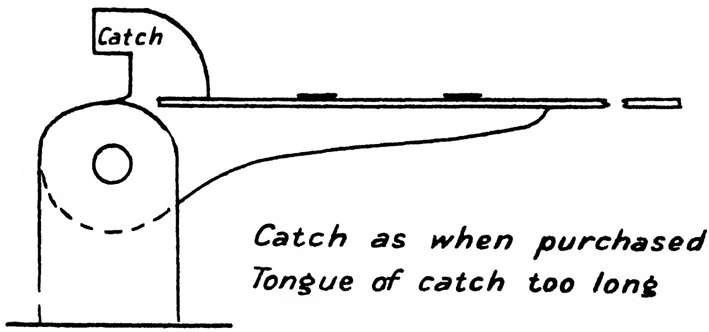


Fig. 3.

In order to provide for (b), file the catch which grips the tongue when the trap is set, very short, as shown in Fig. 4, so that the plate will not require to drop very far before the trap is sprung by the dog.

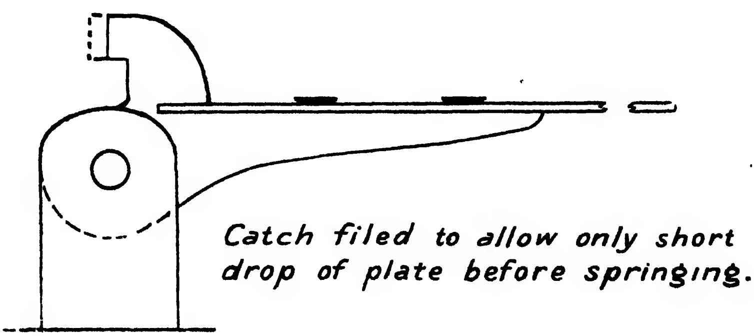


Fig. 4.

When the trap is set the plate should carry about two pounds on the centre without going off; this is to ensure the dog having a considerable weight on the plate when the trap is sprung. This gives him no chance to lift his foot when he feels the plate move. It also helps to avoid catching rabbits and other small game which are not wanted. The adjustment necessary to ensure that the weight of at

least two pounds can be carried in the centre of the plate without springing the trap can be made only by filing the catch at a sharp angle as shown in Fig. 5. The

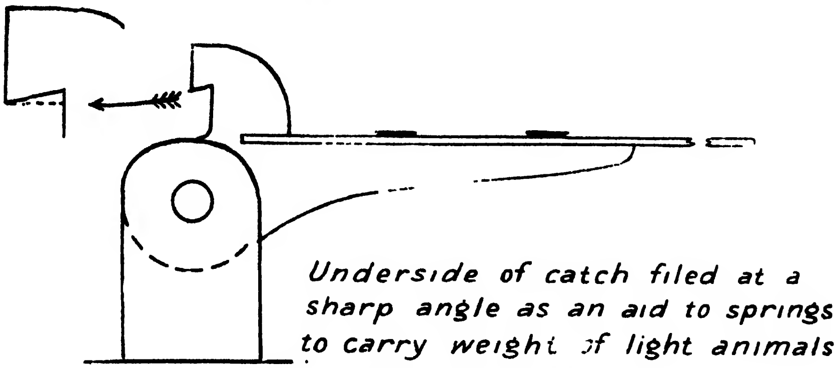


Fig. 5.—Showing method of filing catch

ordinary tomahawk usually carried by trappers often weighs 2 lbs., and when this is so, by loosely holding the end of the handle and placing it in the centre of the plate it can be used to test the weight-carrying capacity of the trap. In order to ensure that the trap is set uniformly each time, the tongue should always be pushed well home, right to the back of the catch.

The correct height of the plate is about 2 inches above the cross bar below, the measurement to be taken at the extreme back edge of the plate, *i.e.*, farthest from the tongue. This will allow plenty of room for the drop for the plate when the dog steps on it. If the back edge of the plate is not set at the height recommended, any sand or loose material sifting under the plate will prevent it being depressed sufficiently to release the catch from the tongue, and so spring the trap. A trap with the plate set at the right height is illustrated in Fig. 6. To make the adjustment referred to in (d) it is necessary to bend the angle iron, to which the

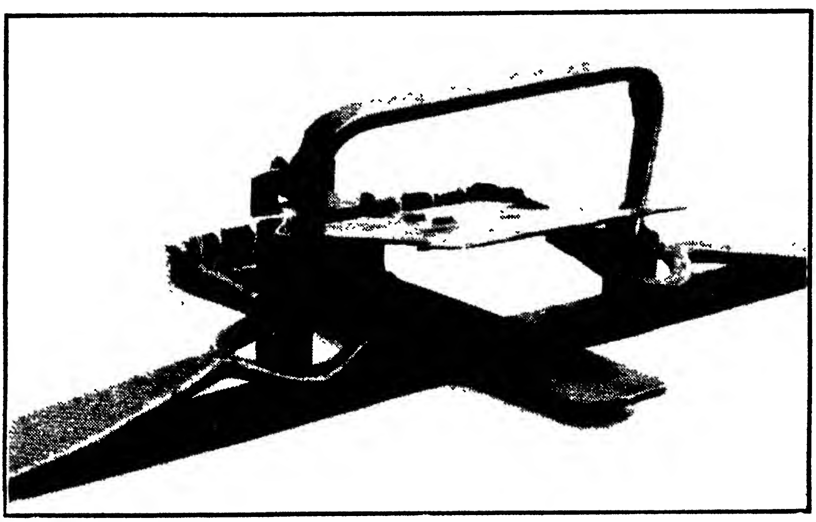


Fig. 6.—Shows height of plate, about 2in. above bottom bar.

tongue is attached, outwards to raise and inwards to lower as required. This can easily be done with a wrench or b ystriking the corner of the bar a sharp blow with a hammer, taking care not to damage the tongue. Set the trap, hold the plate up firmly against the tongue with the fingers, and tap back the tongu egently towards the plate. This will free the inside of the rolled edge of the tongue from the metal bar to which it is attached, leaving it to revolve freely when the trap is set off.

"KEEP THE TRAPS CLEAN."

Always clean traps thoroughly to remove smell. This applies more particularly to a trap which has already made a catch. A trap should be free of any strong smell, such as grease, oil, blood or smell of a dead animal. The smell on the trap will often cause a dog to scratch a trap up. Once a dog has located a trap in this way, he will look for them and usually proves a very hard animal to deal with. The only smell required is the decoy placed for the specific purpose of attracting him, and every effort should be made to prevent his attention being drawn from it, either by sight or smell. Some years ago, a station manager asked for assistance to destroy some dogs which were doing a great deal of damage on his property. He had already trapped two dogs but was unable to catch any others. He stated the dogs were scratching the traps up. On taking up some of the traps it was found that not only were the traps dirty, but that the medium used to carry the poison for the jaws of the trap was greasy wool. This carries a strong smell and was probably the reason why the traps were dug up. The traps were thoroughly cleaned, clean cotton waste used to carry the poison for the jaws as recommended. The gratifying result was that the remainder of the dogs were caught in a few days.

POISONING THE JAWS OF THE TRAP

For this purpose strychnine is used.

To poison the trap, bind a piece of clean cotton waste on that jaw of the trap which is held down by the tongue when the trap is set. This is clearly shown in the illustrations one and two. The reason for using this particular jaw is because it is farthest away from the dog's nose when he approaches the trap, thus minimising the possibility of any slight smell on the waste attracting his attention. One jaw is quite sufficient to poison, providing it is well done. The waste should be secured very tightly with thin wire. If waste is not obtainable, use thin cloth or other material that will tear easily. Do not use string for tying, as it is too easily broken. Wire is the best. To prepare the waste for the poison smear golden syrup, treacle or honey on it, working it in thoroughly with a knife. Then apply the strychnine. The minimum amount used is as much as will lay on a sixpence, but it is better to use more. Work it thoroughly into the waste and syrup. There is a general idea that it is possible to place an overdose of strychnine on the trap; this is quite an error; it is the practice of the writer to use sufficient to kill twenty dogs. The only time when this plan of using plenty of poison fails is when it is not properly done. When a dog is caught in a trap, his natural instinct is to bite at the trap to free himself, and in so doing he will swallow any small piece of material he bites off the trap. The aim, therefore, is to use a material that will tear away in small pieces. If taken in small pieces the dog will often swallow the whole of the waste, wire and all. By doing this, he receives sufficient strychnine to destroy himself.

A trapper recently advised he could not obtain results from the poison on the trap, and it was evident something was wrong with his methods. On examining a

poisoned trap, it was found he was using a strong piece of cloth loosely attached to the jaw with a piece of string. The result was that when the dog commenced biting at the trap, the string broke, the strong cloth came away in one piece, and the dog dropped it. When this was explained to him, the cause of his failure to obtain results was obvious. By binding the waste tightly on with wire there is no chance of the dog removing it in one piece. He must tear it away in small pieces and so poison himself. Another instance of the value of poisoning the trap occurred some years ago in the Wiluna district on the bank of a deep creek. The bed of the creek was some twenty feet below the level of the surrounding country and was very stony, containing a permanent pool of water. The walls were torn out, cavern like, for some miles. A narrow path led down through a cleft in the bank to the water. At the time, this was a favourite watering place for dingoes. Two traps were set on the bank above, close to the path. The mate of the trapper was new to the job, and very keen to see a dog trapped. The camp was about 100 yards away, in the edge of the scrub, and a clear view was to be had of the place where the traps were set, but the trappers could not be seen by any approaching animals. Early next morning two dogs were sighted coming down the bank of the creek. This being the first time traps had ever been used here, it was confidently expected these dogs would be easy to trap. (In fact, nine dogs were trapped in four days.) Following the path, the leader, a big cream-coloured dog, soon scented the decoy, and went straight into the trap. He yelped loudly, and made off, savagely biting at the trap. Rolling over and fighting with it he disappeared over the bank of the creek, crashing on to the rocks below with great violence. On clambering down the bank, the trap was found with one of the jaws broken; this had occurred when the dog fell, and released him. Some of the poison had been bitten off, but it was not thought that he had eaten sufficient to destroy him. However, it was decided to track him and find out. The creek opened out into a sandy bed, making tracking comparatively easy. About three-quarters of a mile from the place where he left the trap, the dog was found lying dead. He had simply dropped dead in his stride. The short time he was in the trap proved his undoing, the galloping evidently accentuating the action of the strychnine, as he made no struggle by taking fits as usually follows the action of strychnine poisoning. Had that particular trap not been well poisoned, the dog would have got away and thus become another "educated" animal to be dealt with later.

Poisoning the trap has other advantages besides the actual destroying of the dog. It prevents him from taking the trap very far, avoiding the risk of losing it, and saves the trapper a lot of time tracking or searching for it. It also prevents damage to the trap itself. In rough, stony or heavily timbered country, traps often suffer damage from the dogs dragging them over stones, stumps and dead timber. This applies to the more delicate parts of the trap, such as the plate and tongue. Years ago, before the poisoning system had become as efficient as it is to-day, traps were damaged by being dragged about to such an extent that it was necessary to take them to a forge to properly repair bent, twisted or broken tongues and plates, and, when working in the out-back areas, this often put one or more traps out of action for some time. When working with pack horses, only a limited number of traps can be carried, and the loss of the use of these traps out of action was quite a serious matter. As a rule, when poisoned as recommended, the traps will be found quite close to the original spot where they were set.

STUDYING THE DOG'S MOVEMENTS.

Having prepared the trap, it is necessary to do some preliminary work to select a suitable site for setting it. The first thing to do is to find the beat of the dog, and form some idea as to his habits. This is absolutely essential to obtain the best

results. The usual procedure of an experienced trapper is what might be termed "localising" the dog or dogs, as the case may be. That is, to explore the surrounding country for some miles. To do this thoroughly, it is necessary to find the quiet spots where dogs camp in the day time, where they drink, hunt, and during the breeding season, where the pups are likely to be found. Dogs invariably have favourite camping places, and these must be located and dealt with to clean the dogs out of a district. It is not sufficient merely to trap dogs as they appear on the property. One must work farther afield, and on their breeding grounds, to stamp them out.

To do this, the movements of the dogs must be traced by tracking. Dogs like good travelling ground, such as sandy creek beds, roads, paths or similar places to protect their feet and make progress easier. Wild dogs and foxes are nocturnal animals, that is, they do most of their travelling by night, and will avoid bad travelling ground as much as possible. This is of great assistance to the tracker, and dogs can be trailed many miles in this way. The older the dog becomes, the wider the radius of his beat extends, and the knowledge he acquires is remarkable. His intelligence is wonderful, and can only be appreciated by careful and patient study of his movements. There is much to be admired in the thorough and efficient manner in which he operates. To the average sheepman, he is merely a ruthless killer, to be exterminated as quickly as possible, but to men who follow his movements with keenest interest, he proves an elusive and clever creature, worthy of the greatest skill and ingenuity that the trapper can use against his cunning. Because this is realised, there are times when a keen regret is felt that the successful efforts of the trapper makes it necessary for them to be the final cause of his downfall. The dingo is never at a loss, both in securing food and water, quiet camping places, and good travelling. Contrary to the common idea, he does not move about the country in a haphazard fashion but is very regular in his movements, working out a definite plan of campaign.

The nature of the locality which he inhabits, also plays a very important part in regard to the extent of his wanderings. For instance, in the dry open spaces of the inland pastoral and desert country, a radius of 40 or 50 miles is quite a common beat for old dogs. Scarcity of food and water, and well protected breeding places, make this necessary. This does not apply to the rough coastal and heavily timbered areas of the South-West. Abundance of food and water, plenty of natural cover, render this unnecessary, and the difficulty of travelling through thick undergrowth retards progress. Dogs have regular visiting places, throughout the entire length of their beat, and these are the best places to set the traps. Corners of cross-roads, or the junction of two roads, gate-posts, corners of paddocks, along fences, near dams, soaks, rocks, old camps, along creeks, watercourses, around the edges of swamps or salt lakes, are favourite haunts. Old sandalwood camps where piles of chips have accumulated have a peculiar attraction for dogs. Possibly the smell of the sandalwood chips is the reason for this. If you look carefully round these places, you will find where the dog has relieved himself, and scratched on the ground, usually near the foot of a tree, post, small bush or tuft of grass. This is the spot for the trap.

SETTING THE TRAP.

Place the trap on the ground with the tongue nearest the post or bush, about a foot from it. Mark out the shape of the trap on the ground as a guide. Place a bag on the ground to kneel on, and whilst digging the hole for the trap place all earth and debris removed upon it. The hole should be a little larger than the trap, and deep enough to place the trap slightly below the surface level. When the hole

is ready, place a small peg in each corner of the hole where the nearest jaw is to rest. This is shown in Fig. 7. These pegs should be driven in firmly, to come

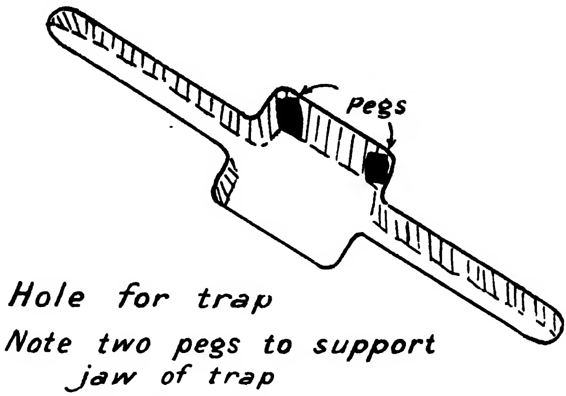


Fig. 7.—Hole for trap, showing pegs on which jaw nearest the trapper is set.

under the extreme ends of the jaw, and prevent possible interference with the plate, and should be low enough to allow the jaw, when resting on them, to be slightly below the surface level.

When the trap is placed in the hole, it is necessary to tilt it towards you, as in Fig. 8, to bring the plate level, parallel with, and slightly below the

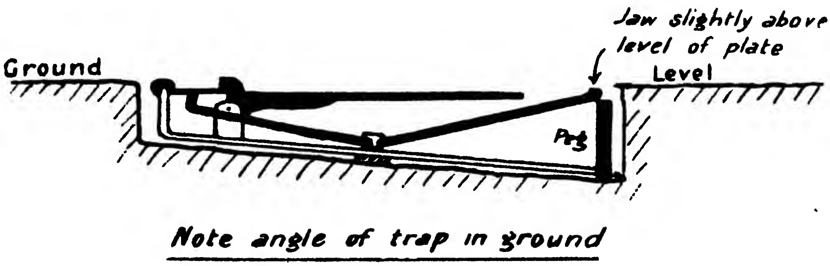


Fig. 8.—Trap set in ground.

surface. Raise the jaw before doing so. When the correct level has been attained, lower the jaw on to the pegs, making sure it is seated firmly upon them. The top edge of the jaw should be a little higher than the plate level. Never on any account leave the jaw below the plate level. This helps to insure the animal having his foot inside the jaws before the plate can be depressed. The raising of the outer jaw has also another advantage. When the jaw is raised, it is lifted clear of the looped ends of the springs. This leaves the entire pressure of the springs to bear on the jaw which is clamped down by the tongue. When the dog treads on the plate, his weight presses it down, releasing the tongue. The pressure of the springs bearing entirely on the inside jaw, forces it up. Continuing the upward movement, the springs come in contact with the second jaw, forcing it upward also, till the jaws finally grip the dog's leg. This gives the trap a tendency to close more rapidly than is the case when both jaws are resting on the springs. Rapid action is essential in the movement of the trap, and no pains should be spared in endeavouring to bring this about.

It may be necessary to try the trap in the hole several times before the correct fit is obtained. Before finally placing the trap in the hole, make sure the tongue is fitted correctly in, and to the full depth of adjusted catch, also that the rolled eye is clear of the metal, as previously described. Now take hold of the two clips or loops which are used to clamp the springs down when setting, and draw them back towards the ends of the trap as far as possible. Lift the trap by the ends, still gripping the loops with the thumbs, and place it in the hole. By doing this, one or more of the loops will not be left holding down the springs, a common fault with inexperienced trappers.

Trappers have been known to place the trap in the hole, and with the idea of embedding it more firmly in the ground, move it endwise, allowing the clips to slide along, partly holding the spring, thus preventing the trap from properly closing. This is sufficient to allow a dog to escape.

When the trap is firmly seated, cover the ends to within two inches of the jaws with earth or sand, pressing down firmly; take some dry horse manure, dead leaves or other suitable material, and with a small stick tamp this all round the jaws and over the looped ends of the springs, taking care no small stones or sticks, etc., fall in the trap, which may prevent it closing. The use of horse manure or leaves where directed will not allow the earth or sand to fall into the trap, and also prevents the earth from setting round the jaws of the trap. This applies more to heavy loam or clay country rather than sand. After rain, loam or clay dries hard and sets like cement, often preventing the trap from going off, or making it sluggish in motion. The manure or leaves keep the jaws of the trap free to move, and it will still be efficient even after heavy rain.

Now take some thin twigs, strong grass or rushes, about three inches long, and arrange round the jaws and plate, to form a framework to carry the paper. This is shown in Fig. 9. Take two small sticks about as thick as a wooden match, and place one at each end of the outer jaw, on the outside of the jaw, touching it. These can be seen in Fig. 9 at the front corners of the plate and also in Fig. 14 with a

Fig. 9.—Trap prepared, with twigs to carry weight of paper with covering soil

thin stick against them. Leave these pegs protruding about half an inch above the surface level, for reasons which will be referred to later. The plate should now be covered with paper. For this purpose two pieces, overlapping an inch in the centre, are preferred rather than one. Each should be 9 inches long by 5 inches wide; these are the correct measurements for a trap of this size, but of course if other sizes are used, the size of the paper will need to be in proportion to the size of the trap used, keeping in mind that the paper covering should extend 1½ inches clear all round the jaws, with an inch overlap in the centre. Ordinary newspaper serves the purpose very well, but avoid using stiff, or strong paper. This may retard the working of the trap, and is not so easily tapped down on to the plate as described later.

In Fig. 10 two pieces of paper are shown laid loosely over the trap, with the join across the centre of the trap, parallel with the springs. To place the papers in position, lay the first piece over the back or tongue portion of the trap, leaving it extending about 1½ inches beyond the back of the tongue. Lay the second piece

Fig. 10.—Trap covered with two pieces of paper, overlapping in centre and ready to receive the covering soil.

over the front portion in a similar manner, overlapping the first piece across the centre of the plate. Make two small slits or holes to allow the two small pegs previously referred to to protrude through the paper. Cover the paper completely with powdered earth or sand, of the same colour as the surrounding surface. To do this it is a good plan to make a small sieve by punching holes in a tin about ⅛ of an inch, or sufficiently large enough to allow the sand to run through freely. A "Trufood" milk tin, or similar tin, is excellent for the purpose. By using this, it prevents large gravel or small stones etc. from falling into the trap and also distributes the sand evenly over the paper. Do not cover more heavily than is neces-

sary, providing the paper is well hidden. Fig. 11 shows the first covering with the two pegs still in view. Take a stick with a flat end and tap gently all over the

Fig. 11.—The first covering of soil, before tamping.

plate, using the stick endwise. It will be seen that this disturbs the paper, exposing parts of it, particularly the corners, as shown in Fig. 12. The tapping causes the

Fig. 12.—First covering of soil, after tamping. Paper showing through in places.

paper to bed down firmly on to the plate. To avoid overloading the paper with sand, smooth the surface over with the stick, apply more sand if required, and tap the same as before. After this operation has been repeated once or twice, you will find little or no movement. If this tapping were not done, a small animal such as a rabbit, cat or bird, walking on the trap would disturb the covering without setting the trap off, and spoil the work.

When this part of the job has been done properly, take some small dry leaves, or other suitable material, and sprinkle over the surface to make the place where the trap is set look as natural as possible. Be careful not to use anything that will interfere with the working of the trap, or turn the dog off. This is shown in Fig. 13, the two small pegs being the only visible sign of the

Fig. 13.—Trap finally covered with leaves and debris so that surface appears natural.

trap and marked in the illustration by two small white x's. Take a few dry sticks or twigs such as might be lying about (not freshly broken sticks or green timber), place these around outside the jaws and over the spring, to prevent the dog approaching the decoy from the sides. Don't over-do it (you are not making a sheep yard); it takes very little to turn a dog off. Take a small straight stick, no thicker than an ordinary lead pencil, about eight inches long and place it along in front of the two little pegs previously referred to, and to which attention was drawn in the illustrations. It will now be observed that these pegs serve a double purpose. Now the trap is covered, they first indicate the exact position of the jaw of the trap, and next, the additional and specific purpose for which they were put in, to prevent the stick which is placed against them from being pushed into the trap. The pegs are clearly shown in Fig. 14. This stick is placed in this position to ensure that the dog when approaching the decoy will place his foot on the plate and not on the jaw of the trap. This is ensured because a dog will not tread on even a very small stick if there is a clear place to put his foot. Wild dogs are particularly careful of their feet, as their very existence largely depends on them. The stick is

lying along the edge of the jaw. This will break the dog's step, and prevent him treading on the jaw. As previously explained, it is quite a simple matter for a dog to accidentally tread on the jaw of the trap, press the end of the plate down with his toes, and set the trap off.. The rising jaw forces the foot upward either clear of the trap, or merely "nips" his toes. By placing this stick in position, this may be prevented.

In the illustration 14, white sticks were purposely used to make a strong contrast in the illustration. The trapper would use his judgment, and in consequence

Fig. 14.—Twigs placed on sides of location of trap to prevent dog from approaching from side; straight twig in front of trap and against pegs to ensure dog stepping over it on to plate of trap.

the sticks would harmonise with those in the locality. In the illustration, also in order to emphasise the need of them, more sticks were used than were absolutely necessary. Here again the trapper must use his judgment and make things look as natural as possible.

DECOYS.

Never tie or secure the trap in any way, as this would give the dog something to pull against and he would soon free himself, even at the expense of a portion or even the whole of his foot. If the jaw of the trap is poisoned, as detailed later, the dog or fox will not take the trap very far.

It might be mentioned here, that trapping is a time job. This does not mean a great deal of the trapper's time, but the traps may be set for some time before the dog comes along. The longer a trap is set, the more certain it is to do its work when the time comes. Wind and rain will have their effect in disposing of smell and tracks. It is necessary, therefore, to provide for this by making a thorough job of the setting and taking sufficient time to do it thoroughly; "more haste less speed" applies specially to dingo and fox trapping.

Place the decoy on the ground in front of the bush which is directly behind the trap, about 12 or 14 inches from the front stick. This is also shown in Fig. 14 and indicated by a small white x. Do not plant it in the bush, but leave it where it can be easily seen.

Some trappers prefer to place the decoy much farther away, but it is found that a dog will invariably place his foot within a few inches of a decoy if it is placed on the ground, providing, of course, there is nothing to make him suspicious of danger. A few pieces of dog manure, with a little urine, if obtainable, poured on it, is an excellent decoy. Chemically prepared decoys are not recommended, dog products are the best. Having set the trap, remove all surplus earth and other signs of disturbance, obliterate tracks etc., with a piece of brush, and, if possible, sprinkle with water lightly over the place where the trap is set. This will prevent the leaves, etc., from blowing about, also assist to remove all smell and tracks. Under ordinary circumstances a few days is sufficient to remove all trace of human smell, but it is as well to assist as far as possible in removing it, hence the use of sprinkled water.

INSPECTING THE SET TRAPS.

When inspecting traps, do not approach nearer than is absolutely necessary to make sure there is no sign of disturbance. Watch carefully for any sign of paper showing. If this should occur, cover again with as little handling as possible. If it can be avoided do not inspect traps too early in the morning, or late in the evening. This is a very favourable time for dogs to come to the trap.

Wild dogs lay up during the day, and move late in the evening, usually after sundown, throughout the night and early in the morning, usually camping after sunrise.

If there is more than one dog about, it is a good plan to set traps in pairs, about a chain apart. Often one dog will get caught, and the other will wander about, awaiting its mate, and finally locate the second trap. If this does not happen, the second dog will often come back the next night or two, and the other trap is ready to do its work. Many pairs of dogs have been secured in this way.

CARE OF TRAPS AND POISON.

Traps should be given the same care as any other implement the settler uses. Unfortunately, this is not always the case. Only recently a visit was paid to the property of a settler who had the reputation of being not only a good farmer but a very careful and methodical man with his machinery, etc. Generally this may have been correct, but certainly did not apply to his traps. For, on making an exploration of his barn, machine sheds, smithy and other places, an odd trap was found here and there, covered with oil, grease, fowl manure, and all kinds of filth. After industrious investigation of a heap of nondescript looking old scrap, containing parts of broken machinery, old vehicles, various portions of the anatomy of a defunct "Lizzie," and other contraptions of a similar nature, obviously used as a fowl perch, several objects which had once been dog traps were found. Continuous throwing about, and piling of scrap iron (not to mention the "Liz.") on top of them had reduced these to a sorry looking collection. One could hardly help wondering whether he fully deserved the reputation he had acquired. If the unfortunate sheep which were lying dead in his paddock could have sized up the situation, they would also have wondered.

It was pointed out that these traps, properly cared for and used in the correct manner, could easily have saved him a lot of money. On his own showing he had lost several hundreds of pounds worth of sheep through dogs during the past few years.

It is also necessary to guard against the deterioration of the traps resulting say, from rust or damage from being set in salty country. A personal experience illustrates the need for this. On one occasion it was found that poor trapping results were being obtained in a certain district. The settlers were interested; some had traps of their own, and the Road Board supplied others and freely loaned them to settlers. Despite the interest taken the traps failed to catch the dogs. The district referred to was chiefly lake country, and the salt nature of the ground in which trapping operations had been carried out had had a very disastrous effect on the springs of the traps. The settlers evidently did not realise this, and were continuously re-setting traps which were in a very bad condition. A number of traps were examined and found to be in such weakened condition that the springs could easily be depressed between the fingers and thumb. In fact, some were so bad that there was not sufficient strength left in the springs to lift the weight of the trap itself by a stick which had been used to spring the trap. One can easily imagine the disastrous effect of the use of these traps, which would barely hold a rabbit, much less a powerful dog, and readily understand why this district is still cursed with mutilated and cunning dogs. It is essential, therefore, that all traps be tested from time to time, particularly in salty country, before being set.

Many people set their traps and leave them set for an indefinite period. Many of these are set off by rabbits, etc., and are left exposed for dogs to see (which is a very bad fault), and also at the mercy of the elements and passers by, who often "remove" them. Some are left so long the owner even forgets where he set them, and when they are needed cannot be found. When dogs are about, the place for the traps is set in likely spots to do their work. When not in use, they should be cleaned, the poison removed, the loops drawn back to leave as little tension on the springs as possible, and carefully stacked away, or better still, hung up in a shed. Traps treated in this manner will last for years, and are always at hand when wanted. The writer has several traps which have been used for a number of years, and although they have caught many dogs they are still efficient.

When using strychnine, remember it is a deadly poison; therefore it is necessary to take every care. Many people are afraid of it, but providing reasonable precautions are taken, there is no danger to the user. Strychnine is essentially an internal, or stomach poison, and therefore will not harm the hands or skin, but after using strychnine it is always advisable to wash the hands well, to avoid the possibility of conveying it to the mouth. Take care to keep it in a safe place. When a strychnine bottle is emptied, it should be smashed and the cork destroyed. By doing this, there is no chance of others, particularly children, using it. If at any time strychnine in tins or other vessels is used, it is always a wise plan to punch holes in, or otherwise dertroy them, when finished with, for the same reason. There is little more to add, but to again state that the poison and the trap are the most effective weapons which can be employed against the dog and fox; therefore, they must be treated with the respect and consideration they deserve.

PICA AND THE EVOLUTION OF A STOCK LICK.

Geo. L. Sutton,
Director of Agriculture.

[By courtesy of the Australian Broadcasting Commission. Prepared from Broadcast given on the 17th November, 1933.]

As it is quite possible that some of those listening in may not be familiar with the word "Pica," and its meaning, it will not be out of place, in the first instance, to say something about it. The word is used medically, ecclesiastically, and industrially, and in each sense its meaning its different. The title of this broadcast implies its association with the health of stock, and therefore, in this instance, it is used in the medical sense, and means a depraved appetite that impels the animal to eat decomposing or other matter which it would otherwise shun.

A much more impressive synonym is chthonophagia. This, however, is more difficult to spell and remember and is readily discarded in favour of the short Pica. Pica is sometimes pronounced Peeka, and, as this had an appeal because of its pleasanter sound, authorities were consulted to learn if the pronunciation Peeka were permissible. The New Oxford dictionary gave no warrant for this and so p-i-c-a must be pronounced pie (as in magpie), kar (as in karoo)—Pi-ka.

Sometimes an animal will have a craving for only one kind of unusual material, as, for instance, cattle for bones; the pica may then be given a specific name, "Osteophagia," which means a craving for bones, or "Sarcophagia" applied to sheep when they have an unnatural craving for decomposing flesh. When the craving is not specific and therefore confined to one particular material, but is general, and the animal has an appetite for all and sundry kinds of debris, the pica is called "Allotriophagia."

And now, to link up this unnatural craving with the use of a stock lick. For the beginning of this story, it is necessary to go back over twenty years and some 5,000 miles to the veldt of South Africa, when and where Sir Arnold Theiler and his colleagues were called upon to investigate a disease known as Lamziekte. This disease was causing enormous losses amongst the veldt-reared cattle. In March of 1919 Sir Arnold Theiler, after more than eight years patient work, was able to announce definitely that the cause of this devastating disease had been discovered. The investigators found that the direct cause of this disease was a ptomaine poisoning brought about by the cattle swallowing a toxin or poison developed by an anaerobic organism on decomposing bones which, because of their pica, they licked or chewed. This organism was similar to that known as Bacillus botulinus, and so the South African stock disease could be included in the general scientific term "botulism." This was later to prove of very great economic importance to Western Australia.

The poison produced by the organism producing "botulism" is extremely deadly; how deadly it is may be imagined from the fact that, in the laboratory experiments conducted by Sir Arnold Theiler, it was found in one instance that a dose of less than half a grain, given by an injection under the skin, produced a typical case of the disease and death in a bullock weighing over 600 lbs. When given by the mouth the fatal dose required was found to be much larger, but, even under these conditions, less than 1/30th of an ounce was found to be fatal. In one experiment about 1/10th of an ounce of what was regarded as only moderately toxic material produced a typical Lamziekte in less than a week.

This poisonous material is, however, found only on decomposing material which cattle with normal appetites would shun, and, in consequence, it was only those with pica which developed the disease. Further, investigations proved—

1. That the "pica" was due to a phosphorus deficiency in the diet of the animals, *i.e.*, the pastures grazed by them; and
2. That the depraved appetite, and therefore the disease, could be cured, or rather prevented, by feeding a supplement, which would make good the phosphorus deficiency in the diet.

In the case of the experimental animals this was done successfully by giving them daily, or tri-weekly, doses of bonemeal, and from this practice was evolved the less troublesome one of placing supplies of bonemeal in suitable receptacles where the veldt-grazing cattle could "lick" or take what they required. This was stage one in the evolution of our stock lick.

And now it is opportune to transfer the story to our own State. In 1928, an owner of a property in the central Wheat Belt reported that his sheep were dying from what he considered to be Braxy-like disease. In a flock of approximately 400 sheep depastured on wheat stubble, a number were observed to be readily eating decomposed rabbit carcases dug out of a warren that had been fumigated with carbon bisulphide several months previously. Fifteen sheep died. Dr. Bennetts, the departmental Veterinary Pathologist, investigated the case and diagnosed it definitely as botulism, thus linking up the "lamziekte" of the South African veldt-grazing cattle with the deaths of the stubble-grazing sheep in Western Australia. The treatment prescribed was to destroy the carcasses and remedy the phosphorus deficiency of the stubble pasture by the addition of another food or stock lick rich in phosphates. As had been the case in South Africa for lamziekte a bonemeal lick was recommended and with equally successful results.

In South Africa the particular form of "pica" manifested by the cattle was bone chewing. Those with the appetite in a mild form chewed only sweet or bleached bones; this form was not serious as the effect of the weather had been to remove the poisonous material from the bones. The cattle with an advanced stage of pica craved and chewed bones with decomposing meat on them. It was these cattle that swallowed the poison and developed the fatal disease lamziekte. On the South African veldt, bone chewing was so feebly manifested by sheep that these animals rarely developed lamziekte. In the West Australian case referred to the sheep had passed beyond the bone chewing stage and had developed a craving for decomposing rabbit carcases. This implies an extreme phosphorus deficiency in our pastures. Hence the need for phosphatic licks is increased.

Though the treatment prescribed by Dr. Bennetts was definitely successful yet, owing to the cost of sterilized bonemeal—about £25 per ton—and in view of the results obtained in South Africa with other phosphatic supplements, it was considered unnecessarily expensive. At the time the belief was expressed that, as precipitated calcium phosphate had proved superior to bonemeal, the necessary supplement would be supplied in the future by a specially prepared and comparatively cheap precipitated calcium phosphate. Such a material is now available under the name of "Dicalcic Phosphate."

Though this was not available at that time there were two calcium phosphates on the market, the cost of which was less than that of sterilised bonemeal. These were recommended pending the time when either a precipitated calcium phosphate or a cheaper bonemeal would be available. The two calcium phosphates referred to were basic superphosphate and finely ground rock phosphate. Basic superphosphate had the advantage that it contained precipitated calcium phosphate, but its

disadvantage was that it also contained about 50 per cent. of gypsum, which, so far as is known, serves no useful purpose and must be regarded as an adulterant. Rock phosphate had the advantage that it contained a greater percentage of phosphorus than basic superphosphate, but in the South African experiments this proved less effective per unit of phosphorus than bonemeal.

Either compound could have been used separately, but with the object on the one hand of reducing the amount of adulterant in the basic superphosphate, and on the other of improving the efficiency of the rock phosphate, a mixture of the two in equal proportions was recommended. As both compounds were likely to be unpalatable to sheep and cattle, and, as the likes and dislikes of animals are matters of importance when licks are fed separately from the ration, it was necessary to mix them with something to increase their palatability. Molasses and salt were recommended for this purpose. The formula of the suggested lick was as follows:—

Basic superphosphate or ground rock phosphate ..	10 parts.
Salt	5 parts.
Molasses	2 parts.

This was stage two in the evolution of our stock lick.

This lick was placed upon the market under the name of Formula C. by the Cuming Smith-Mt. Lyell Farmers' Fertilisers, Ltd. It was sold at £7 10s. per ton and used with satisfactory results, and supplied its phosphorus at less than half the cost of that supplied by sterilised bonemeal.

In May, 1932, the same company placed upon the market a high grade "precipitated phosphate" called dicalcic phosphate, containing 37 per cent. phosphoric acid. The Cresco Fertilisers (W.A.), Ltd., also market a similar product containing 36.75 per cent. phosphoric acid. The phosphoric acid in dicalcic phosphate is considered by Sir Charles Martin to be twice as available as that in bonemeal and three times as available as that in ground rock phosphate.

The price of the commercial dicalcic phosphate is £15 1s. 6d. per ton, and with this as a base, the manufacturers—Messrs. Cuming Smith-Mt. Lyell Farmers' Fertilisers, Ltd.—at the request of the department, have prepared a commercial dicalcic phosphatic lick containing 18 per cent. phosphoric acid to replace Formula C. The cost of this F.O.B. at metropolitan works is £10 1s. 6d. per ton, or 12s. 6d. per cwt. A comparison of the relative values of this lick and the old Formula C. is interesting. Formula C. differed from the dicalcic lick in that it contained less phosphoric acid, viz., 15 per cent. compared with 18 per cent. Further, the dicalcic lick contains its phosphorus in a much more available form than in the old lick. In the old lick less than one-third was in the form of dicalcic phosphate, the balance being in the form of tricalcic phosphate, and this is considered to be only one-third as digestible as in the dicalcic form.

Having regard, therefore, to the lower percentage and lower availability of phosphoric acid in the Formula C. lick, it is calculated that with Formula C. at 8s. per cwt. it would be necessary to spend 17s. 6d. on that lick in order to obtain the same amount of useful phosphorus as can be obtained by spending 12s. 6d. on the dicalcic lick. It will thus be seen, when the comparative values of the essential constituents are considered, that the new dicalcic lick while dearer in actual price, is actually cheaper by several shillings per cwt. even when bought at the cwt. rate and not at the ton rate. Further, Formula C. contained a considerable quantity of gypsum which, though inert, was of no value to the animal, which was, therefore, better without it.

A comparison between dicalcic lick and sterilised bonemeal is also interesting. The metropolitan price of sterilised bonemeal is £24 11s. 6d. per ton, or 25s. per cwt. At this rate the cost of 18 per cent. of phosphoric acid as found in the standard dicalcic lick is 20s. 6d. Comparing this with 12s. 6d., the cost of the same amount in the dicalcic lick, it will thus be seen, that on the basis of phosphoric acid content alone, bonemeal is not nearly as economical as dicalcic lick. Seeing that the phosphorus of bonemeal is not as available as that in dicalcic phosphate, this places bonemeal at £24 11s. 6d. per ton in a still more unfavourable position when compared with dicalcic lick at £10 1s. 6d. per ton.

Compared with prepared phosphatic licks the cost of the phosphoric acid in dicalcic phosphate is low. The easiest form of comparison is based upon the cost per unit of phosphoric acid. In dicalcic phosphate a unit of phosphoric acid (P_2O_5) costs 7s. 11d. The prepared licks contain ingredients other than the constituent containing phosphoric acid. In some cases none of these will be of value to the animal. If the value of these be ignored and only the cost of bags and mixing be deducted, it is found that for nine representative licks the unit costs of phosphoric acid range from 8s. 9d. to 106s. 3d., or, in the latter case, over thirteen times the cost of the unit in dicalcic phosphate. Even when making allowance for the commercial value of all the supplementary ingredients in the prepared licks the range in unit cost is from 8s. 4d. to 70s. 11d.* This range shows that stock raisers must consider the purchase of their stock licks not as patent medicines, but in an intelligent and business way and buy them just as they buy ploughshares or superphosphate, in accordance with relative values and prices.

The necessity for this is shown by the fact that, though the Western Australian need is for a phosphatic stock lick, there are at least two commercial licks on the market which contain no phosphate at all, and several others which contain such a small amount of phosphate that it would be impossible for an animal to eat sufficient to satisfy its need for additional phosphorus. On the other hand some of the commercial stock licks contain quite satisfactory amounts of phosphate and at reasonable costs. These are a great convenience to those who have no desire to mix their own licks, but such, if practical and business-like, will shun those which, after due allowance has been made for the commercial value of all the ingredients they contain, appear to have a margin of something like £25 per ton—75 per cent. of listed price—for selling costs and profit.

Because of its quality and its cheapness dicalcic phosphate will obviously be the base of the modern phosphatic lick essential to make good the deficiency of our stubble and other dry summer pastures. The question arises, "Are any other supplements necessary with which this should be mixed?" The dicalcic phosphate is tasteless and odourless, and will, therefore, have no natural attraction for stock. To overcome this disadvantage the addition of some molasses is advisable. Further, animals feeding on dry pasture, and particularly on stubble, have a considerable need for common salt. This then should also be added. There is no evidence that, under normal conditions, any other ingredients are necessary. The standard stock lick recommended and evolved from the results of the classical work carried out in South Africa and applied to West Australian conditions is—

Commercial dicalcic phosphate	45 parts.
Stock salt	40 parts.
Molasses	5 parts.
Water	10 parts.

*The commercial value of the other ingredients were calculated from the following rates:—Salt, £3 per ton; molasses, 6s. 6d. per cwt.; meals (valued as bran), £6 per ton; potassium iodide, 16s. per lb.; sulphate of iron (com.), 15s. per cwt.; flowers of sulphur, 18s. per cwt.; epsom salts (magnesium sulphate), 15s. per cwt.; bags, 50lb. 4s. 6d., 75lb. 6s., 112lb. 7s., 180lb. 9s. per dozen.

Now, what of the other ingredients which were common to stock licks not so long ago—lime, sulphur, sulphate of iron, sulphate of magnesium or Epsom salts.

Lime was added on general principles because it is useful in building up bones. The dicalcic phosphate supplies lime combined with phosphate and in a suitable proportion. The addition of extra lime is likely to be detrimental by disturbing the lime-phosphorus balance in the animal's body.

Sulphur is a mild laxative and may be useful on that account. It was, however, added mainly because it was known that it is an important constituent of wool, and it was accordingly assumed that it would be useful to the animal for the production of wool. It is now known that free sulphur as supplied in licks cannot be used by the animal for this purpose.

Sulphate of iron is a tonic, but was included with the object of destroying stomach worms. It is no longer recognised as effective in this connection. It is, however, astringent and, in consequence, is likely to increase the constipation due to feeding on dry stubble. To correct this, magnesium sulphate or epsom salts was added. There is, therefore, no need for these if the iron be omitted, as it should be.

Finally, it is important to emphasise that the fundamental reason for using stock licks is to make up deficiencies that are known to exist in the food. In as far as they serve this purpose they are useful and advisable, but in most cases they are wasteful and may even be harmful if they supply materials which are not lacking. It is, therefore, not advisable to use, without veterinary advice, licks which contain ingredients which are not known to be required to make up deficiencies in the diet. At present there is no definite information to indicate that generally there is any deficiency in our normal pastures other than that of phosphorus, and, in consequence, the only known need at present is for a straight "phosphatic stock lick," that is, a lick containing suitable phosphates, and only such other substances, indicated above, as are required to make it palatable to stock.

THE HOME TANNING OF SHEEP AND OTHER SKINS.

H. SALT, B.Sc., A.I.C.

(Reprinted from Departmental Bulletin in response to numerous requests.)

1. The skins should first be made as clean as possible. Dried skins must be soaked in water for two days or more until just as soft as fresh skins.

All the fat and loose skin on the flesh side (*i.e.*, inside) must be scraped off, because the greasier the skin, the slower the penetration of the tanning liquors.

Boil a few ounces of soap with water, and when dissolved make up to about a gallon of cold water. Use the solution *cold* to wash dirt and grease from the skin and wool. A few drops of phenyle or other carbolic disinfectant is useful in the washing water. When the skin is clean enough remove all trace of soap by rinsing.

2. Dissolve 1lb. alum and ½lb. salt in two gallons of water. Dissolve 1oz. (no more) of soda in a pint of water, and add to the first solution. Stir well for five minutes.

Soak the cleaned skins in the liquor for at least one week. Thick skins and greasy skins will take several days longer. It is always best to allow plenty of time for tanning, because over-tanning is improbable, but under-tanning might easily result. If the tanning vessel is big enough, lay the skins out on the bottom, but if they must be doubled up whilst tanning, move them at least twice a day. This prevents uneven tanning.

If desired chrome alum can be used instead of ordinary alum. Chrome alum is the more expensive, but has the advantage that the tanned skin will stand much more washing, and is generally better.

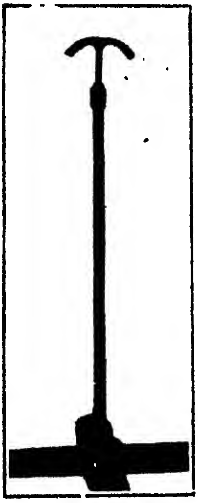


FIG. 1.—A small staker.

3. When the skins are tanned through (a little cut in the neck should be the same colour right through) wash them once in cold water. Too much washing is not advisable, but the alum is best removed from the wool. Let them drain over a pole with the wool outside for a few hours till they feel thoroughly damp but not wet. Then nail them on a board, stretching them out as flat as possible. The better the stretching in drying, the easier is the working up afterwards.

If a slight greasiness and smell does not matter in the finished rug, rub a little *soft grease* or Neatsfoot oil over the flesh side before nailing out to dry.

When quite dry leave the skins a week or two so that the tannage can mature.

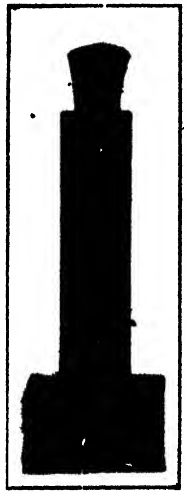


FIG. 2.—A staker made from an axe head.

4. The great secret of making a soft alum leather is in working it up well after drying. For this purpose a staking tool can be made of a piece of metal (or perhaps hardwood). This is shaped as shown in Fig. 1. The edge is blunt; an old axe head with blunt edge and rounded corners will serve quite well. An axe mounted for this purpose is shown in Fig. 2. The top of the axe should be about three feet from the ground.

FIG. 3.

To soften them, the skins are pulled over this edge as shown in Fig. 3. A considerable amount of pressure can be used.

If the skins are damped on the flesh side with a little water to soften them, they will stake much easier. Very little moisture is needed for this purpose, and some preliminary softening can be given by working with the hands.

Unless the loose tissue has been scraped off well before tanning, the staking will raise the flesh side. If the loose flesh has not been removed before tanning, this can be done now by rubbing with pumice-stone, or by gently pressing the skin to a quick-moving grindstone. A better method than the former, and safer than the latter, is to throw the skin over a pole and scrape it with a round tin lid (the lid of a tobacco tin will serve, but a larger one will work the skins quicker). Scraping must be done with judgment.

The skins should now be soft, and the flesh side fairly smooth. The wool can be combed, brushed, and, as a final finish, a narrow strip can be cut all round the skin, since the edges are often difficult to soften.

When mats of this nature are washed they sometimes dry hard. A little staking will always soften them.

Points to remember:—

1. The wool on a fresh shin is more likely to be firm than the wool on a skin which has been kept some time.
2. If the wool needs washing, do it before tanning.
3. Give the skins plenty of time for tanning, and do not forget to turn them.
4. If there is a horny streak in the middle of the dry leather, the skin is not fully tanned.
5. Pliable leather is obtained by working the skins after tanning. A damp skin is easiest to soften.

BARK TANNAGE.

Tannage with bark is not very easy in rough conditions, and, on the whole, is much slower. The skins are best lightly tanned first, and then finished with stronger liquors.

All iron must be avoided, if possible, because the tannin will blacken with iron, so that, after drying the bark, it is advisable to break off any portions blackened by the iron of the axe. Break up the dry bark in small pieces, and soak for a day. The following quantities may be found very suitable (and at least one should be available in most parts of the State):—

Mallet, 1 lb.; Wattle, 1½ lbs.; Mallee, 2½ lbs.; Gimlet, 1½ lbs.; Wandoo, 2 lbs.; Jam, 5 lbs.

One gallon of water to the amount of bark given above is used for soaking, and one-third of this is added to a gallon of fresh water. The skins are allowed to lie in this weaker solution until tanned through. This can be judged by making a small cut in the thickest part of the skin, and observing whether it appears the same colour right throughout.

When this first tannage is complete add the rest of the liquor, and leave for another week. The skins can be finished off as for the alum tannage if hard, but if they have been tanned through they should be soft enough for rugs.

The quantities of bark are, of course, approximate, and must be varied according to the amount of liquor required. If several skins are to be tanned in succession, the old liquor from one lot will serve as the first liquor for the next lot, strengthening up after the cut shows an even colour. A liquor should improve with constant use up to the third or fourth time.

TO DEHAIR COWHIDE.

As numerous inquiries have been received, Mr. A. Arnold, Chief Inspector of Rabbits, has supplied the following information:—

Soak the hide in fresh water, if it is a dried one, to which a few handfuls of washing soda has been added, until the hide is quite limp and soft as a fresh hide. Remove all scraps of fat, flesh, etc., and rince once of twice.

Now put the limp hide in a solution of unslaked lime and water, in the proportion of two to four ounces of lime to the gallon. Soak for 24 hours, the hair should then come out; if not, make up a fresh liquid and soak again, when the hair will come away from the skin readily by scraping with a blunt instrument. Give the skin two or three soakings and rinsings to free it from any lime, and then spread out to dry in the shade.

Before the skin is quite dry, rub in a little mutton fat or tallow and work the skin well. It will then be soft and pliable when dry: this will make what is called "Greenhide." Omit the fat or tallow if the skin is to be tanned.

"MAKING HAY WHILE THE SUN SHINES."

General information regarding the cutting of cereal crops for hay with special reference to oaten hay.

The following broadcast talk was given from Station 6WF on 6th October, 1933, by Mr. I. Thomas, Superintendent of Wheat Farms. It was one of a series of popular educational talks on agricultural subjects and is published by courtesy of the Australian Broadcasting Commission.

Hay-making is the process of cutting edible herbage of any kind and drying it by exposure to the sun and air. During this process the moisture content is reduced from about 75 per cent. to about 10 per cent. This greatly checks fermentation, which, in the presence of sufficient moisture, soon occurs in stored vegetable matter, with the consequent evolution of heat.

The conversion of green fodders into hay has been practised for centuries, and may have been the first great step in changing the nomad herdsman of ancient times to the settled farmer stockman.

Hay forms the greater portion of the artificial foodstuffs fed to the larger animals which perform labour and produce food for man. It is also fed to other stock to supplement natural pastures, in this State during the late Summer and Autumn months.

When fed to working horses or other stable-fed animals it is usually chaffed. The chaffing process does not increase the nutritive value, but makes it more convenient to handle and transport, and prevents waste in feeding.

During hay-making the most important change is the loss of moisture, which naturally varies considerably with the nature of the crop, and also with the stage of maturity when cut.

The value of any fodder is determined by the amount of digestible nutrients that it contains. In the case of hay this is largely dependent on the type of crop from which it is made. The choice of crops to be used for hay purposes is

determined mainly by the prevailing growing conditions. For instance, in England, nearly all hay is made from meadow grasses. On the other hand, in the wheat growing districts of Western Australia, practically the only source of hay is one or other of the cereals. Only in our more favoured rainfall districts is it possible to grow commercial hay crops of lucerne, clovers or grasses. Fortunately, the climatic conditions are admirably suited for the growth of one or other of the cereals—wheat, oats, barley and rye. Rye is not satisfactory because of its relatively low nutritive value for hay and is little grown in this State; barley gives hay of good feeding quality but is not favoured because of its objectionable awned ears. Wheat and oats, however, produce excellent hay and are extensively grown for that purpose.

The making of hay is an art which can only be acquired with practice, but there are certain general principles to be borne in mind. The object is to secure a fodder of the highest nutritive value and in this connection the time of cutting the crop is of the utmost importance. When seed formation begins the most valuable nutrients are rapidly transferred from the lower portions of the plant to the developing seed, and the nutritive value of the stems and leaves decreases correspondingly, until, when the stage of complete ripeness is reached, they are to all intents and purposes simply straw of very low feeding value. It follows, therefore, that if the best quality is to be obtained, the crop must be cut at a stage when the nutriment is more or less evenly distributed over the full length of the plant.

The greatest weight of material is obtained if the plant is cut when the grain is full-sized, but still in the dough stage. At this stage of growth, however, the lower parts of the plant have started to dry off and have become less digestible. At the flowering stage the nutriment is distributed over the full length of the plant and little change in the digestibility takes place until the grain is almost full-sized, but still in the milky stage. It is after this that the nutrients begin to leave the lower parts of the plant and go to form grain. With the development of the grain there is a decrease also in the digestibility of the nutrients and the rate of decrease becomes greater as the plant nears maturity. Therefore, the best quality hay of optimum weight is obtained after the plant has flowered and the grain is in the milky stage and almost full-sized. When cut and properly cured at this stage the hay will be of a bright green colour of good aroma, retaining the leaves and other small parts of the plant, and free from dust or mould.

Experiments have shown that carefully dried young plants are equal in value to the fresh article but in actual hay-making there is always some loss of nutritive value. Exposure to the sun reduces the palatability by bleaching and causes a loss of aromatic compounds; dew works injury and rain carries away the more soluble portions. An experiment showed that hay exposed for thirteen days to alternate wet and dry weather lost more than 25 per cent. of its original nutritive value.

After cutting the crop a certain amount of fermentation takes place, but this is soon arrested by the drying action of the sun and wind. When the partially dried material is collected in stacks or barns the processes of fermentation recommence. If the hay contains an excess of moisture fermentation is favoured and the temperature rises. Under very favourable conditions for fermentation the actual ignition point of hay may be reached and a smouldering combustion may result.

It is obvious that the likelihood of fire can be prevented by thoroughly drying the hay before stacking. This is not altogether satisfactory for if over-dried it does not ferment sufficiently to develop the aroma, flavour and colour desirable in good hay.

Following upon the cutting of the crop the sheaves should be stooked without delay. Exposure to rain results in soluble food ingredients being washed out and the sun dries out the essential oils and other volatile compounds. To minimise these losses by protecting the sheaves from the action of the sun and wind a number are placed or stood together in well-made stooks. Comparatively long open stooks are preferable for moist districts and large round ones for dry districts.

If heavy rain is experienced between the time of cutting and stacking, the stooks should be inspected. If it is found that the rain has penetrated into the stook, the sheaves should be disturbed to allow of free circulation of air. It may be necessary to dismantle the stooks entirely and so let the sheaves dry somewhat before re-stooking. Unless this is done musty and mouldy hay will result. At the same time restooking should be delayed only long enough for the excess dampness to dry out, otherwise the quality of the hay will rapidly decrease because of bleaching. It is desirable to emphasise the importance of this attention after rain, because much sickness and loss is caused by feeding musty or mouldy hay to stock.

The hay is allowed to remain in the stooks until it is sufficiently dry so that, when placed in the stack, it will not heat or mould. This stage may be determined by drawing a handful of stalks from the middle of the stook and examining the knots or joints. If these are dry, and the material when twisted in the hands breaks freely, it can be stacked without danger. When this point has been reached, the hay should be stacked as quickly as possible, otherwise it will deteriorate in quality.

At the end of each day, during the time the hay is being stacked, it is as well to adopt the practice of pushing the long handle of a pitch fork well into the centre, but towards the bottom of the stack, and let it remain there over-night. Should it not be unduly hot the following morning, the stacking can be continued with confidence.

Once the stack has settled down, the hay undergoes little further change, retaining its attractive appearance and aroma over very long periods. Gradually, however, the aroma disappears, the hay becomes britte, dusty and less palatable and can then only be used satisfactorily along with other fodder.

Wheat crops affected with the disease Flagsmut should not be cut for hay as this is a certain means of spreading the disease. The same applies to crops infested with Wild Turnip, Wild Radish and other noxious weeds.

The fact that the inclusion of oats in the cropping system of the wheat farm is necessary in connection with the control of the wheat diseases, Take-all and Flag Smut, which are taking such a large toll of our wheat yields each year, makes it essential that larger areas of this crop should be planted. Unfortunately, the resulting grain crop is not normally as remunerative as wheat. It is, therefore, usually more profitable to harvest the crop for hay. Some farmers, however, are reluctant to do this, because they are not aware that oaten hay is equal to wheaten hay when both have been cut at the correct stage and properly cured.

The chief cause of trouble in feeding is that in many cases oaten hay is not cut until the crop has reached the stage when the grain is full-sized and in, or past, the dough stage. It is claimed by those who practise this late cutting that if the crop is cut earlier, horses will not eat it readily, but this is not in accordance with experience. In one case, an advocate of late cutting severely criticised the cutting of a crop considered to be too green, but later the same person favourably commented on hay made from this crop when cut into chaff and used by him to feed his own horses.

Another objection raised to growing oats for hay is that they grow too rank and coarse. Under normal climatic conditions it will usually be found that such

crops have been planted before the main grain crop. This practice is followed so that the hay may be cut and stacked before the harvesting of the grain commences. With late maturing varieties, as "Algerian," such a practice was essential, but with the more recently introduced early maturing varieties, such as "Burt's Early" and "Mulga," this practice in most districts is not now necessary. The most satisfactory stand is obtained when the seed is planted in accordance with the Departmental seeding calendar advocated for the different maturing varieties in the district in which the farm is located. As most farmers are more familiar with the maturity of wheat varieties, the following will act as a guide for the planting of oats—the late maturing variety "Algerian" would be planted during the period recommended for the late maturing varieties of wheat—"Yandilla King" or "Sutton"; "Guyra" oats a mid-season variety, the same time as "Nabawa," while "Burt's Early" or "Mulga," early maturing varieties would be planted the same time as "Gluyas Early" wheat. Greater or lesser bulk of material can be expected when the seed is sown earlier or later.

It should be the aim of every farmer to produce hay of the best quality, and this can only be done if the various processes involved are properly understood. In conclusion, therefore, I would emphasise that to obtain this high-quality hay it is important that—

1. The crop intended for hay be planted during the period most suitable for the maturity of the variety grown;
2. It be cut shortly after the plants have flowered and when the grain is in the milky stage and almost full-sized;
3. The sheaves be stooked immediately after the crop is cut;
4. The stooks receive attention after rain; and
5. The hay be stacked without delay after the material has sufficiently dried.

FIRE CONTROL ON THE FARM.

By A. C. SHEDLEY, B.Sc., Dip. For.

The following was given as a broadcast talk through Station 6WF and is published by the courtesy of the Australian Broadcasting Commission.

The term "bush fire" is applied by Australians indiscriminately to all fires which burn grass, hay, stubble, scrub, or forest. In many parts of Australia there are regions of wide extent and small population, where bush fires are a regular occurrence each summer. They may burn for weeks on end without exciting any interest or comment, despite the fact that such regions include areas of valuable forest. On the other hand many so called "bush fires" are confined to other farming or pastoral country and although not the direct concern of the forester, may eventually become so if they are likely to encroach on to forest country.

In a country such as Australia, extending from a tropical North to a temperate South, and including high mountain regions, there are many varied soil and forest types, and among the 300 different Eucalypts and other tree species are to be found associated with them very many vegetative types. This vegetation may vary from grass in the open woodlands, through woody scrub in the drier forest areas to dense green vegetation in the wetter areas. In W.A. the scrub over the majority

of the State is of a woody nature, while small areas of grass country are occasionally met with, as, *e.g.*, in the Tuart forest along the coastal limestone belt, while in the Karri country the more succulent vegetation is common.

Grass country will burn every year, the dry scrub of the Jarrah belt only once in every two or three years, and the scrub in the moister areas perhaps only once in five or six years This means that there is a greater accumulation of debris which causes very dangerous bush fires in some parts of Australia, notably Victoria, during certain days of high wind and low humidity. There is evidence that fires occurred in many forest types before the first white settlers arrived in Australia, but as a general rule the floor of the virgin forest carried a less severe fire and the blackfellow showed considerable discrimination in his use of the firestick.

Among the most remarkable characteristics of the Australian "bush" is the manner in which the mantle of green foliage is quickly replaced even after a severe crown fire and effectively hides all damage from the casual observer. Some Eucalypts, however, are killed outright by a severe bush fire.

Fires have been put through forest areas by stock-owners all over Australia to improve their grazing value by burning off the old grass and inducing young shoots from the hard woody scrub, and similar burning occurs to-day in the South of France.

It is maintained by many people with some show of altruism that it is better to get the forest alight as frequently as it will burn, rather than protect it for many years, in order that debris may be allowed to accumulate and then catch alight with disastrous consequence to the whole countryside.

Stringent fire-laws are a necessary foundation for both fire prevention and fire suppression. Southern Australia is a land of long dry summers, and the recognised necessity for careful protection of cereals and pastures in early summer is clearly shown in the various Acts for the prevention of bush fires. The Bush Fires Act, of 1902, W.A., makes provision for prohibited times during which it shall be declared unlawful to set fire in the open. This prohibited period is fixed by *Gazette* notice, on the recommendation of the various Road Boards, and although it may vary slightly from district to district, it usually takes effect from November, which is before the summer fire hazard commences, and extends to the middle of February, which is the hottest period.

No person, however, shall burn any part of the bush—which means grass, stubble, scrub, bushes, trees and all other vegetation, at any time during the months of October to April, both inclusive, unless—

(a) he has delivered or caused to be delivered personally to each owner or occupier of all adjoining lands, four clear days' notice in writing of such intention:

(b) he keeps at least three men in attendance until all grass, stubble or scrub has been burnt, to prevent such fire extending beyond the limit of his own land or land occupied by him.

Subject to these two conditions and during such prohibited times any owner or occupier of land may burn off the bush between two plough breaks or spade breaks, between the hours of 8 o'clock in the evening and 12 o'clock midnight, for the purpose only of protecting any dwelling house or other building or stack of hay, wheat or other produce within ten chains of a dwelling house or other building.

Provided also that the outer break shall not be distant more than ten chains from the property to be protected.

There is another section which is of more interest to the general public, and it provides that a person lighting or using any fire in the open air for the purpose of cooking or camping shall clear a space of ground of a radius of ten feet at least, and shall completely extinguish the fire before leaving the place.

To make these points clear—

1. During the prohibited period as gazetted for each Road Board, usually from November to February, no burning can be undertaken except restricted firebreak burning by night to protect buildings, hay, wheat, etc., under conditions set out.

2. From the end of the close season, usually some time in February, burning can only be carried out until the end of April, provided notice is given to adjoining occupiers and three men are kept in attendance.

3. From 1st May until the end of September there are no restrictions about burning off.

4. From 1st of October until the closing of the fire season, usually some time in November, burning is permissible provided notice is given to adjoining occupiers and three men are kept in attendance.

5. At all times during the year a space of ground of a radius of 10 feet at least must be cleared before a person lights a fire in the open for cooking or camping.

The amendments of the Bush Fires Act, in 1925, made provision, *inter alia*, for any defined portion of the State to be declared a fire protected area, and within such gazetted area it is necessary for a settler to obtain a permit before carrying out any burning operations at any time of the year. The only areas so declared at the present time are those within a certain radius of Collie and Mundaring Weir, where fire towers have been erected for the detection of fires, and in those districts the Forester issuing the permits is enabled to investigate the area before burning is carried out, choose the time and weather conditions suitable to the particular locality, and satisfy himself that the landholder is prepared to take the precautions necessary.

Under the Forests Act of 1919—

> Any person who sets fire in the open air to any tree, wood, bush or grass, on any land contiguous to a State Forest or timber reserve, without giving notice of his intention to a forest officer so as to allow such officer to be present at the firing, commits a forest offence.

In the development of a country, fires play an important part in the clearing operations, and in burning off the woody scrub to provide a certain amount of rough grazing. It has been suggested that after the summer there should be two periods for burning off, one for the burning after clearing and the other for burning scrub, stubble and grass, at a later date. The cleared areas are usually confined to comparatively small areas, the fire quickly passes over them, and if proper precautions are taken there is little risk of the fire escaping. This early burn would provide the maximum of time for the clearing up of the area before the winter months.

The burning of scrub, stubble, and grass, which is often carried out over extensive areas without any attempt being made to confine the fire to a definite area could well be left until a later date when on account of the cooler weather conditions control would be much easier.

The limiting of these clearing fires is more important at least in the South West, than for scrub or grass fires, because of their greater severity, and, owing to the fact that the areas are relatively small and intensively worked, this can

usually be accomplished by taking simple precautions including the prior construction of firebreaks.

In the Wheat Belt the outbreaks of uncontrolled fires which sweep the country are largely accidental and are mainly caused by stationary or traction engines or more rarely by burning off.

The problem is to a great extent solved by the cutting of hay on strips around the boundaries of paddocks, followed by the ploughing of breaks, before the main crop is ready for harvesting, by burning out during the winter months of the dense scrub growing in the low lying areas; and by co-operative effort in extinguishing an outbreak when it occurs. There is, however, need for organised effort in this regard, and information concerning the practice in other States and the formation of fire fighting associations to cope with bush fires will be given in the next article.

Where sheep is combined with wheat farming, the conservation of feed and the protection of it from fire during the summer months are just as important, although perhaps not so difficult of accomplishment because of the more thorough clearing methods adopted, and to the fact that owing to the absence of scrub the uncleared forest country does not burn so readily as it does in the South West.

In the South-West of the State the uncontrolled fires which devastate the country arise chiefly from the burning off operations either directly, or indirectly, by people burning back from their boundary towards fires in the vicinity. The opening of the close season is always marked by the numerous smokes which arise from burning off operations which make observation from Forest Department lookouts and location of fires a very difficult matter.

There are, of course, in addition, fires lighted by irresponsible or ill balanced persons who are apparently governed by a desire to see the bush burn.

In the South West, control of fires is more difficult especially on account of the early stage of development of most holdings. Owing to the high cost of burning up the heavy stand of timber which is found on nearly all properties in the South West, clearing for pastures is not so thorough as for cultivated crops, and is usually carried out by grubbing the smaller and ringbarking the larger trees. These ringbarked trees for many years are a constant fire menace, owing to their inflammability, and the ease with which the tops will light up from small pieces of burning bark or decayed wood blown from adjoining trees. It is important then to see that these ringbarked trees do not get alight during the hottest parts of the summer, and the danger can often be eliminated by the provision of protective belts of green timber which can be burnt in early summer or by burning early a strip of grass country between two ploughed strips surrounding paddocks to be protected.

These belts of green trees burnt in early summer before there is much chance of a fire escaping, can be placed over the property so as to break up the hazards, they can often be selected on account of their unsuitability for growing heavy pasture crops and yet provide a certain amount of rough grazing and shelter for stock. The burning of scrub associated with jarrah trees will often be easier to control in the autumn, during the months of April and May, when the leaf litter which has accumulated on the ground during the summer months from the falling of the leaves from the native trees will assist in carrying the fire and making a much clearer burn. The dewy nights will also assist in damping the fires which will frequently go out at night if started during the afternoon.

Too often no attempt is made on the wheat belt or the South West to isolate new clearings which are to be burnt later in the summer or to consider the clearing in relation to other areas, the burning of which would result in the escape of the fire from control.

By studying the direction of the wind, and selecting suitable weather conditions, providing protective belts as mentioned previously and taking the necessary precautions to have men in attendance as provided by the Act, chopping down ringbarked trees if they are too near and likely to prove dangerous, and raking around any green tree which is likely to carry the fire up its flakey bark or catch alight on the top from some lighted material being drawn up by the rising of the hot air, the burning off operations become a simple matter, without serious risk of the fire getting away. This is evidenced by the considerable amount of controlled burning which is annually carried out by the Forests Department on fire belts surrounding treated compartments and adjoining private property, and over country which is not carrying re-growth or would not suffer from a light burn put through when conditions are not severe.

The practice of the Department in burning the country in advance of felling operations of the mills or sleeper cutters and then burning up the tops of the trees which have been felled, has resulted in the saving of much valuable immature timber, and in preventing the starting of fires in such highly inflammable material during the summer months.

This control of burning operations has relieved many farmers, whose properties adjoin State Forest, of the constant fear of bush fires, coming in from open country on to their properties.

It is hoped that arrangements will be made to broadcast during the coming summer, information about the approach of "blow up" days, *i.e.*, days of high temperatures accompanied by strong dry winds, when any small fire is a potential raging bush fire, almost impossible to control and liable to do untold damage.

These days most frequently occur in January and February, but even in March, after the opening of the fire season, there are days when burning off is attended with too much risk, and the information broadcasted should be of material assistance to the farmer in avoiding such days for lighting fires.

POTATO GRADING.

E. T. MORGAN, Officer-in-Charge, Potato Branch.

The grading of potatoes has received more attention since 1930 than at any previous time in the history of the potato industry of this State. The primary cause of this interest was the regulations under the "Agricultural Products Act, 1929," dealing with potatoes and gazetted in 1930. After two years working it was found necessary to have alteration made in the grading regulations, and in August of this year (1933) a new set of regulations was authorised and published in the "Government Gazette" of 11th August, 1933.

The said regulations state that—

14. (1) Potatoes grown in Western Australia and intended for sale either in the State of Western Australia or in any other State of the Commonwealth of Australia shall be graded according to the following grades, namely:—

(a) Grade 1.
(b) Grade 2.
(c) New Potatoes.
(d) Seed Potatoes.
(e) Stock Food.

(2) For the purpose of grading potatoes according to the said grades:—

"Grade 1" shall mean sound potatoes, not necessarily of one variety but of similar varietal characteristics, weighing not less than 3ozs. each, mature and free from dirt or other foreign matter, second growth, digging injury, damage caused by disease, sunburn, insects, or greening from exposure.

"Grade 2" shall mean potatoes of similar varietal characteristics, weighing not less than 3ozs., and free from wet or dry rots, dirt or other foreign matter. The term includes potatoes in which a light infection of common scab, second growth, black spot, insect injury or other skin blemish occurs, if the damage resulting from the said causes can be removed by the ordinary process of paring without appreciable increase in waste over that which would occur if the potato were perfect.

"New Potatoes" shall mean potatoes which comply with the standard of Grade 1 in all respects other than weight and maturity of skin. They shall not have a mature skin, but shall weigh not less than 2ozs. each in all calendar months other than July, August, and September, during which months they shall weigh not less than 1½ozs. each.

"Seed Potatoes" shall mean sound potatoes intended for planting and which are of one variety, weighing not less than 1½ozs., and shall be free from dirt or other foreign matter, digging injury, or damage caused by disease, sunburn or insects.

"Stock Food" shall mean potatoes intended for stock food and not for human consumption.

Provided that potatoes contained in any one parcel of potatoes shall be deemed to comply with the standard of a grade, if at least ninety-five per centum thereof by weight comply with that standard.

15. Potatoes intended for sale for human consumption or for seed shall, for the purpose of transport, be packed in new or clean second-hand bags of good quality, or in other containers approved by the Department of Agriculture. Bags which have contained organic manures or any other deleterious or obnoxious substance shall not be used as containers for such potatoes.

16. The bags or other containers in which potatoes intended for sale are packed shall have legibly marked on the outside thereof and in a conspicuous place the name and address of the grower, followed by the word "Potatoes" and the grade thereof.

The importance of properly grading potatoes before sending them to market cannot be too strongly emphasised, and it behoves every grower to exercise keen scrutiny to insure that his product complies with the standard laid down prior to marketing.

The place to grade potatoes is on the farm, and they must be graded before consigning forward; if the seller does not do it, he usually has to pay someone else a big price for doing it.

The realisation that he pays for this service, and that such service is infinitely more expensive in the city than on the farm is rapidly converting the grower to the better policy of home grading.

Well graded stock will always take priority of sale over ordinary stock, whilst ungraded stock usually sells on the basis of the poorest material in the bag, rather than on its average quality.

The greatest cause of failure of potatoes to comply with a given grade is the amount of fork-injured tubers placed in the bag. The system of piece-work digging carried out in many portions of the State renders it extremely difficult of control, and it is only by the strictest supervision of the grower or man in charge that the trouble can be obviated. The majority of the potatoes in this State are still dug with a fork, and this method of harvesting undoubtedly injures many tubers.

Machines have been used on a small scale for a number of years, and where conditions are right the work is performed more satisfactorily and cheaply. If the land has been well cultivated and is free from stumps and stones, the machines will do excellent work. The accompanying photograph was taken on the property of Messrs. Coley and Sons, Marybrook, Busselton, and shows a 12-ton crop of tubers being dug with a mechanical digger, the injury to tubers being practically nil.

The potato digging plough has been in use spasmodically for many years, and is quite satisfactory. Messrs. Packer and Hersey of Cannington, use this implement each year, and two years ago a 16-ton crop per acre was successfully handled by this means. A count taken of mechanical injury showed five cut potatoes in 200 or 2½ per cent., a percentage very much lower than would be obtained by fork digging.

Digging potatoes by hand is slow, expensive work, and it is poor economy to do without a potato digger. Remember, human labour is the most expensive item the grower has at digging time. He cannot afford manual labour when a machine will do the work.

PRICES AND COST OF PRODUCTION.

A. C. JENYNS, Poultry Adviser.

Many poultrymen to-day are in doubt whether to carry on in face of the lower prices offering. This question causes one to turn to the methods adopted on the farm. The reasons why some are not making things pay are obvious. It is only those who realise that poultry farming is a business that requires business methods of as keen a nature as any shop or workroom in existence to-day who will make it a success.

The day of ragtime methods is gone; production has reached a stage when only the best quality in egg and hen will show a profit. Not only must the aim be more eggs per hen, but that hen must be bred and kept on lines that will give longer service, or at least another year of profitable laying. Production costs must also be lowered to meet the lower prices. This does not only mean looking for cheaper foodstuffs, building materials, etc., but to the things which are in the farmer's own hands, on the farm; here is where the greatest *immediate* effect can be shown. Some of the most outstanding features in this lowering of production costs are the most neglected by the producer on his own farm.

GREEN FEED.

This is where a large amount of cost can be reduced. The average farm to-day no matter whether large or small, grows barely sufficient green-feed for one-third of the birds carried. Supply the difference and see the drop in the feed bill; it will be a surprise to many. Too few poultrymen appear to realise the value of green-feed. It should comprise at least from 50 to 70 per cent. of the daily feed, this will not only lower the feed bill, but it lowers the bill of disappointment and loss caused by disease. There would be little need for dosing up the flock at frequent intervals with all kinds of unnecessary preparations if sufficient greens were used. Also the egg would be richer, of better quality, and more enticing to the public, who after all, must in every possible way be induced to realise that a good egg *can* be obtained, not only good in appearance, but in food value.

What a difference it makes to the appearance of efficiency on a farm to see plenty of lucerne, maize, etc., growing, instead of the usual sand patch and sickly stock.

CULLING.

Too many flocks are carrying as many as 30 or 40 per cent. duds, birds which either never have or will show a profit, or birds that have long ago past their day of profitable return. If these were culled out and the value of the food consumed added to the monthly credit, it would in many cases turn loss into profit.

Imagine a farm with 800 or 900 head of stock, 200 of which need culling out. These 200 are eating their two or three ounces of food per day, and giving nothing in return. Cull them out, and the same egg return remains; add the cost of their food to the credit side and see the difference. Start this culling in the incubator and follow it right through every stage of the bird's life. The result will be that only the profitable stock will be brought to the laying sheds. This culling has been done on many farms and the benefits have been so marked it is hard to credit how few farmers are believers in hard culling all the while.

LEG WEAKNESS.

Lack of Calcium.

In regard to leg weakness we hear so much about, cases are brought under notice day after day, and though there are several causes of birds losing the use of their legs, it is found in Western Australia the main cause is lack of calcium. Poultry farmers do not seem to realise that shell grit alone will not supply sufficient of this mineral. Bone meal *must* be used, at the minimum rate of 2½ per cent. daily.

In the majority of cases of leg weakness brought under notice, bone meal has been entirely lacking in the ration. On adding it the trouble has disappeared in a few days. This lack of calcium also has a vital effect on the egg, especially in respect to the shell. Much loss is sustained by growers during the egg export season through weak shells and cracks. It is astonishing how few understand what is needed by a hen to produce an egg of good quality in every way. Where bone meal is fed and increased as the egg yield increases, the shells are kept firm and strong. On the other hand, where no allowance is made for the increased supply of calcium needed, the shells become weaker and thinner, giving more rejects and breakages, and in many cases a large quantity of soft-shelled eggs entirely unfit for market.

These are a few ways in which the cost of production can be reduced and many of the losses on the farm avoided. If poultrymen would turn their minds from higher prices to better management, to bringing costs lower to meet the lower prices, to buying less and making more of their own efforts, and a realisation that in these times it is only by eliminating waste of both material and energy on the farm itself that success can be found, there would be more profitable farms. Prices are governed by that law of supply and demand, and the only way to increase that demand is by giving the public what they demand, "A good article."

Some producers are doing this, but it is the many who adopt careless methods, who are the cause of low prices and low consumption.

Breeding, feeding and general management must be adjusted to meet the existing conditions.

PIGS FOR EXPORT.

W. G. Burges, "Tipperary," Burges Siding.

Geo. L. Sutton, Director of Agriculture.

G. K. Baron-Hay, Superintendent of Dairying.

PRELIMINARY REPORT OF EXPERIMENTS CONDUCTED AT "TIPPERARY," 1932-33.

With the object of providing for the standardisation of porker and bacon pigs to meet the requirements of the local market, a conference of the bacon manufacturers and leading breeders was called early in 1930. The unanimous recommendation of this conference was that the pig best adapted to meet the requirements of the local market for porkers and baconers was the progeny of a Berkshire-Tamworth sow by a Berkshire boar. At the same time it was thought that this cross would also be suitable for the export trade. The development of the pig industry, however, was so rapid that in 1931 it became necessary to find an outlet for our surplus pigs by exporting them to Great Britain and, with a view to ascertaining the type required, a consignment of Tamworth-Berkshire cross pigs was sent from the Muresk Agricultural College and the Denmark Experiment Farm. The reports from London indicated that, although no fault could be found with the quality of the consignment, in every case the covering of fat on the back was too thick.

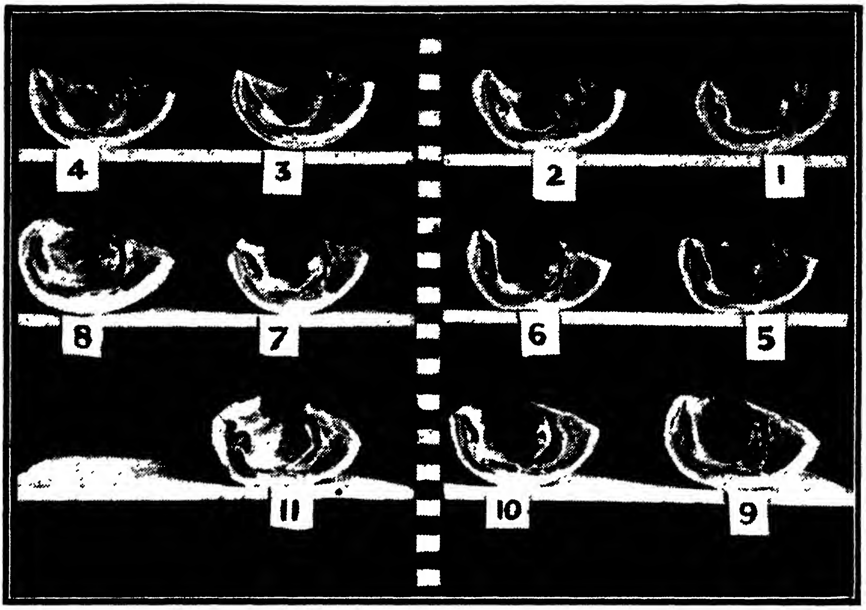
Bearing in mind the very strong recommendation of the Empire Marketing Board for the utilisation of the Large White breed in catering for the British trade, it was decided to carry out experiments in which crossbred pigs produced by mating Berkshire sows with Large White and Tamworth boars would be compared with each other with regard to the suitability of their carcases for the British market.

The experiments were carried out at the Tipperary piggery, which, with its herd, was generously placed at the disposal of the department by one of the authors, who also imported a Large White boar specially for the trials. In June and July, 1932, the first series of experiments was commenced when Large White and Tamworth boars were mated—each to three pure bred Berkshire sows. The first sow farrowed on October 6 and the last on November 23.

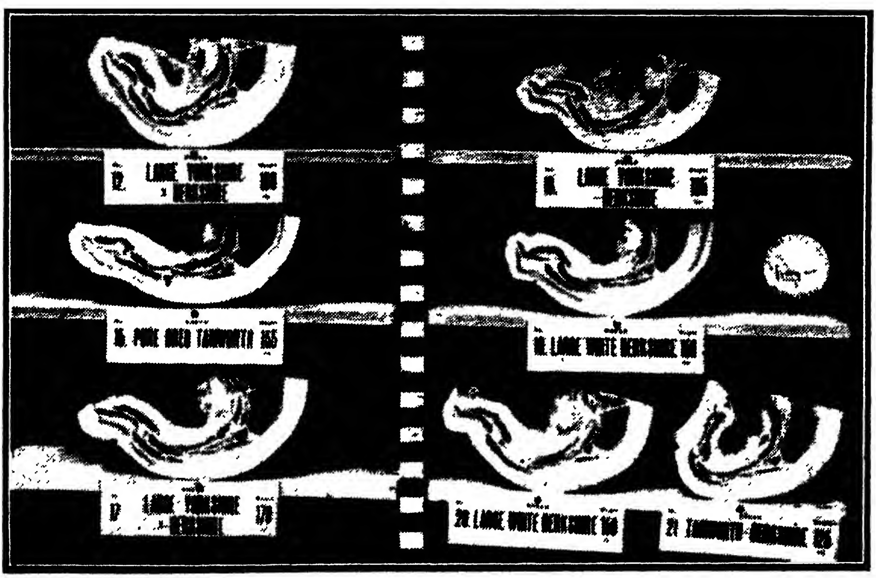
DETAILS OF FEEDING.

All litters received the same kind of food, and the sows were confined to the sty for the first three weeks after farrowing, but afterwards were kept in small fields which are sown to cereals for grazing during autumn, winter, and early spring, the litters remaining with the sows and having access to the same feed in the troughs. Litters were weaned at ten weeks. Until then the sows received a daily ration of two gallons of milk and three lbs. of meal. The unweaned pigs also received meal in addition to their mother's milk—as much as they would clean up readily.

The standard daily ration fed to the weaned pigs was milk at the rate of half a gallon per day when available and, in addition, meal in amounts appropriate to the age of the pigs. The meal consisted of ground wheat to which five per cent. meatmeal was added. If the milk available was less than half a gallon per day, the



New Zealand carcases showing thin layer of fat desired by the British market.



West Australian carcases much too fat for the British market

amount of meatmeal was increased so as to supply the amount of protein previously supplied by the milk. When the pigs in the first litter were almost six weeks old they, and the progeny of the other four sows which had farrowed, were weighed, and the weighings were repeated at intervals of approximately four weeks.

In December, 1932, and January, 1933, a second series of experiments was commenced, when the Tamworth boar was mated with two and the Large White boar with three Berkshire sows. As the pigs reached suitable weights they were consigned for treatment to Messrs. Watson & Sons and Foggit, Jones, Limited., who went to considerable trouble to assist in the work, and who later forwarded them to Messrs. Sheed, Thomson & Co., Limited, London, for sale and report. This firm was very interested in the trials, and not only furnished a special report on the carcases, but also obtained an additional one from Mr. J. B. Swain, of the Empire Pork House.

The report on the first consignment was to the effect that the carcases were the best that had been received from Western Australia, but they were altogether too fat. In the second consignment, carcases of pure Large White and pure Tamworth pigs were included. The reports regarding these were not altogether favourable, the most satisfactory carcases being the Tamworth. In reporting on these pigs Mr. Thomson, of Messrs. Sheed, Thomson & Co., Limited, considered that, as the pigs were bred along the lines recommended and being followed in New Zealand, it must be the feeding that is at fault. Although the way in which these pigs had thriven was very satisfactory, it is possible that some alteration in the feeding whereby they receive a greater percentage of protein than is customary, may be advisable under West Australian conditions. It, however, may be that an alteration in the type of sow used for the production of export pigs will be necessary. It is intended to investigate both these aspects in future experiments.

LESSONS ON THE TESTS.

The conclusions from the experiments up to date are as follows:—

1. Both the Large White-Berkshire and the Tamworth-Berkshire crosses produce carcases of excellent quality, but with condition too fat for the British market.

2. There was greater uniformity as regards weight in the piglets in Tamworth-Berkshire litters than in the Large White-Berkshire litters.

3. The average number per litter of piglets born was Tamworth-Berkshire 8.4 and Large White-Berkshire 8.2; the average number reared was 7.6 and 6.7 respectively.

4. Under average farm conditions the Tamworth-Berkshire cross has proved hardier and more free from disease, particularly pleurisy.

5. No evidence of scalding was noticed with the White pigs during an excessively hot period in the late summer of 1933. On the other hand, every piglet in a litter of 11 about a fortnight old, when let out of the sty for the first time on November 15—a very cool but sunny day—scalded badly. It was found particularly difficult to keep the White pigs free from lice, and it is probable that some of the scalding to which these pigs are said to be subject, is possibly due to failure to keep them free from these vermin, and this, indirectly, causes scald as the result of rubbing.

6. During the summer months the average monthly gains of all crosses were approximately the same.

7. The Large White crosses appear to feel the cold, and during the winter months the Tamworth-Berkshire crosses make definitely greater gains.

8. Indications with the crossing of either the Large White or the Tamworth boar with the Berkshire sow are that it will be necessary to select Berkshire sows of the bacon type—*i.e.*, lengthy sows with light forequarters. It is probable that the Tamworth-Berkshire comeback would provide a more suitable carcase than the Tamworth-Berkshire first cross.

TICK AND LICE INFESTATION.

The Value of Dipping.

HUGH MCCALLUM,
Sheep and Wool Inspector.

Now that the time has come for the annual dipping of the flock, it is felt that its importance as a method of checking the ravages of the parasites, lice and tick, must again be stressed. During the past few years the number of infested flocks has increased, as many sheep owners neglected the operation of dipping when wool prices were low.

There are three reasons why owners should dip their flocks. The first, and this alone should be sufficient to induce them to do so, is that if the flock becomes infested, the wool rapidly deteriorates in quality and this results in a direct economic loss to the grower. When opened up on the show floors where it is displayed for sale a ticky clip appears thin and ill nourished and of a dingy unattractive colour.

Secondly, if dipping is neglected the parasites quickly gain ground, and this may result in a very great loss to the State at a time when the revenue derived from the sheep and wool industry is of such vital importance to it.

Thirdly, if a grower neglects to dip his flock it must inevitably become infested and prove a menace to surrounding flocks. It is almost certain that the infestation will spread to flocks on adjoining properties, no matter how carefully neighbouring owners may guard against it.

There are a number of proved poisonous dips which are quite efficacious providing the instructions for mixing issued by the manufacturers are strictly adhered to.

The dipping should be performed on a sunny day, preferably from 4-6 weeks after shearing. If the sheep are driven long distances to the dip they should be allowed to settle down before dipping is commenced, and none should be dipped within an hour of sunset so that all may dry before nightfall. The dip must be emptied and cleaned out as often as the makers of the dip suggest, in order to avoid dip-stained wool. Each sheep should be completely immersed, and allowed sufficient time in the bath for the dip to reach the skin.

When purchasing sheep always inspect them very carefully to ensure that they are not infested with lice and tick. The pest is often introduced into a flock in this way. In fact, many farmers when purchasing sheep for the first time have, owing to their carelessness, thus introduced the pest into areas in which it had before been unknown.

Farmers may obtain bulletins dealing with this infestation of sheep from the Department of Agriculture. These also give full details regarding the construction of dips.

NITROGEN-FIXING BACTERIA FOR LEGUMINOUS PLANTS.

Pure Cultures obtainable from Plant Pathology Branch.

H. A. PITTMAN, B.Sc. Agr., Plant Pathologist.

INTRODUCTORY.

All green (chlorophyll-bearing) plants require, for their successful growth, certain chemical elements such as carbon, hydrogen, oxygen, phosphorus, potassium, nitrogen, sulphur, magnesium, calcium and iron. These ten substances were formerly considered to be all that were required by green (chlorophyll-bearing) plants, but of recent years it has been found that certain other elements may also be required by some species in comparatively small amounts. Such additional substances are—aluminium, silicon, sodium, chlorine, manganese and boron, etc.

The elements essential for the successful growth of plants do not appear to be interchangeable or mutually substitutable to any great extent, if at all, in the physiology of the plant. Thus a soil which already contains ample potash, for example, in a form in which the plant is able to use it (that is, "available" potash) will not have its fertility (crop-producing power) increased by additional quantities of potash, if some other essential element is deficient in proportionate amount. A lot of extra flour or butter in a cake will not make up for a lack of currants or milk, and the same sort of argument applies to plant nutrition also.

Most soils contain, in available form, abundance of every chemical element required by plants with the exception of phosphorus, potash, or nitrogen. The deficiency of phosphorus is generally remedied by the use of superphosphate, blood and bone, bone dust, etc.; that of potash by sulphate or muriate of potash or Kainit; that of nitrogen by sulphate of ammonia, blood and bone, nitrate of soda, etc., or by the growth of leguminous crops bearing nitrogen-fixing bacterial nodules on their roots.

The growth of leguminous crops does not, *ipso facto,* that is to say, of necessity, increase the nitrogen content of the soil, but only if the roots of the leguminous crop are infected with the appropriate nitrogen-fixing bacteria. Moreover, to obtain the full soil-improving benefit of growing such crops, they must be ploughed in or fed-off *in situ.*

When leguminous plants are infected with the nitrogen-fixing bacteria, characteristic swellings or nodules, which vary in appearance with the particular plant species concerned, will be found on the roots. In these swellings are to be found millions of tiny germs (bacteria) which enable the plant to draw freely on the inexhaustible supplies of gaseous nitrogen in the air—a feat which is quite impossible by any plant, leguminous or otherwise, in their absence.

PURE CULTURES OBTAINABLE.

Pure cultures of those nitrogen-fixing bacteria which form nodules on the roots of certain species of the family Leguminosæ, which includes such important agricultural plants as lucerne, peas, clovers, soy beans, French beans, etc., may be obtained on application to the Plant Pathologist, at the prices indicated below.

These bacteria, after forming swellings known as nodules on the roots of leguminous plants, enable the infected plants to make use of the inexhaustible supplies

of free nitrogen in the air.* Although, in the absence of such nitrogen-fixing bacteria, some legumes may make quite satisfactory growth on soils containing abundance of combined-nitrogen (in the form, for instance, of humus compounds, sulphate of ammonia, etc.), the full economic benefit of growing such plants can only be obtained when the appropriate bacteria are present.

OLD METHODS OF INOCULATION.

A common method of introducing the bacteria on to a new field, or farm, is to inoculate the new area with soil from a field which has previously grown successful crops of the kind under consideration, and on the roots of which abundant nodules have been found. This method is quite satisfactory in most cases, but has the disadvantage of sometimes introducing plant diseases, insect pests, or weed seeds. If attempted, it should be carried out preferably during dull weather or late in the afternoon, so as to minimise the harmful effect of sunlight on the bacteria. About one hundredweight (1cwt.) of infected soil should be used per acre and be well cultivated or harrowed in.

Another method of inoculation sometimes used is to dip the seeds before sowing in some sticky but harmless substance such as skim milk, thin glue, or a sugar-syrup made by dissolving cane-sugar in hot water and then cooling before use. The seeds are made sticky by the treatment, and, after being dried as much as possible by being spread out in a shady place, are rolled about in a little soil containing the bacteria. The sticky seeds take up a coating of the bacteria-infected soil and then are sown as soon as possible.

Where the crop has already been planted, an 8-ounce bottle of culture (see below) may be used to inoculate about one hundredweight of sweet, moist, fertile soil by first mixing the bacteria with water. The heap is thoroughly mixed by repeated turning and is then allowed to stand in a cool shady place for a day or so before broadcasting it over the field at the rate of about one hundredweight per acre. This method does not appear to give nearly as satisfactory results as seed inoculation, at least for annual crops.

USE OF PURE CULTURES VERY DESIRABLE.

In newly-settled areas so far remote from fields already inhabited by the desirable bacteria that the obtaining of soil is not easily, or economically, practicable, the artificial cultures will be found a great boon. They have been used in the past by many farmers in this State, and particularly in the Group Settlement areas, on newly-cleared land, with great success. They are free from weed seeds, insect pests, or organisms causing plant diseases, and in this respect are much to be preferred to the use of infected soil. By the use of infected soil or the pure cultures a good stand may be obtained during the very first year, instead of having to wait three or four years as is otherwise often the case in subterranean clover paddocks, etc.

QUANTITIES AVAILABLE, PRICES CHARGED, ETC.

The bacteria are supplied on the surface of jelly-like agar slopes in two-ounce medicine bottles, or in eight-ounce medicine bottles containing about four times the quantity of the smaller size. To cover cost of materials, glassware, wrappers, postage, etc., the following small charges are made:—

(a) Two-ounce size—1s. 6d.

(b) Eight-ounce medicine bottle size (containing 4 times the quantity in (a))—2s. 6d.

*The average composition of normal air by volume may be taken as follows:—Nitrogen 76.96 per cent.; oxygen 20.65 per cent.; water vapour 1.4 per cent.; argon and other inert gases 0.94 per cent.; carbon dioxide 0.03 per cent.; hydrogen, ammonia, ozone and nitric acid 0.005 per cent.—Newth's "Inorganic Chemistry," pp. 256 and 270, 1920.

AMOUNT OF SEED WHICH MAY BE INOCULATED FROM ONE BOTTLE OF CULTURE.

The contents of a two-ounce bottle will inoculate approximately 20 to 30 lbs. of small seed, such as lucerne or subterranean clover, and 40 to 60 lbs. of larger seed, such as peas or soy beans. The eight-ounce bottle size will treat about four times the quantity of the smaller size.

TABLE 1.

Approximate amount of seed which may be treated with one bottle of culture.

Size of bottle.	Price	Seed of size of lucerne or sub-clover, etc.	Seed of size of garden pea, lupin soy beans, etc.	Milk required.	Calcium phosphate.
2 oz.	1s. 6d.	20 — 30 lbs.	40 — 60 lbs.	½ pint	3.0 gms.
8 oz.	2s. 6d.	80—120 lbs.	160—240 lbs.	1 quart	12.0 gms.

Owing to the time taken to prepare the cultures, farmers are requested to lodge their applications at the Department a fortnight or so before they wish to use the culture.

DIFFERENT BACTERIA REQUIRED FOR DIFFERENT KINDS OF LEGUMES.

The same strain of bacteria will not inoculate every kind of leguminous plant. Thus trefoils and lucerne are inoculated by the same kind, but the lucerne kind will *not* inoculate clovers or peas.

The bacteria which may be obtained from the Department will inoculate the following groups of legumes. *The members of each group are inoculated by the same kind of bacteria, but the plants mentioned in different groups require different bacteria.*

Group 1.—Subterranean clover, white Dutch clover, perennial red clover ("cow grass"), Egyptian clover, and all other true clovers (*Trifolium spp*).

Group 2.—Lucerne, white sweet clover, "King Island Melilot" ("Hexham scent"), medics, trefoils, and all other species of *Medicago or Melilotus.*

Group 3.—Garden pea, sweet pea, field pea, all kinds of vetches or tares, broad bean, tick bean, lentil.

Group 4.—W.A. blue lupin (*Lupinus varius.*)

Group 5.—Soy beans (*Glycine Max*).

Group 6.—Sulla (*Hedysarum coronarium*).

Group 7.—French beans (*Phaseolus vulgaris*).

Group 8.—Cow peas (*Vigna sinensis*).

DIRECTIONS FOR USING THE PURE CULTURES.

Keep the bottles unopened and in a warm, dark place until about to be used. The cultures are useful for at least one month after being received. In the bottles the bacteria appear as a whitish slime on the sloping *surface only* of the agar (*i.e.,* the jelly-like material containing bacterial food).

To inoculate the seeds with the cultures.

The seeds should first be piled on a clean surface. Then take *one half-pint* of fresh skimmed milk for every *two-ounce bottle,* or *one quart* of fresh skimmed

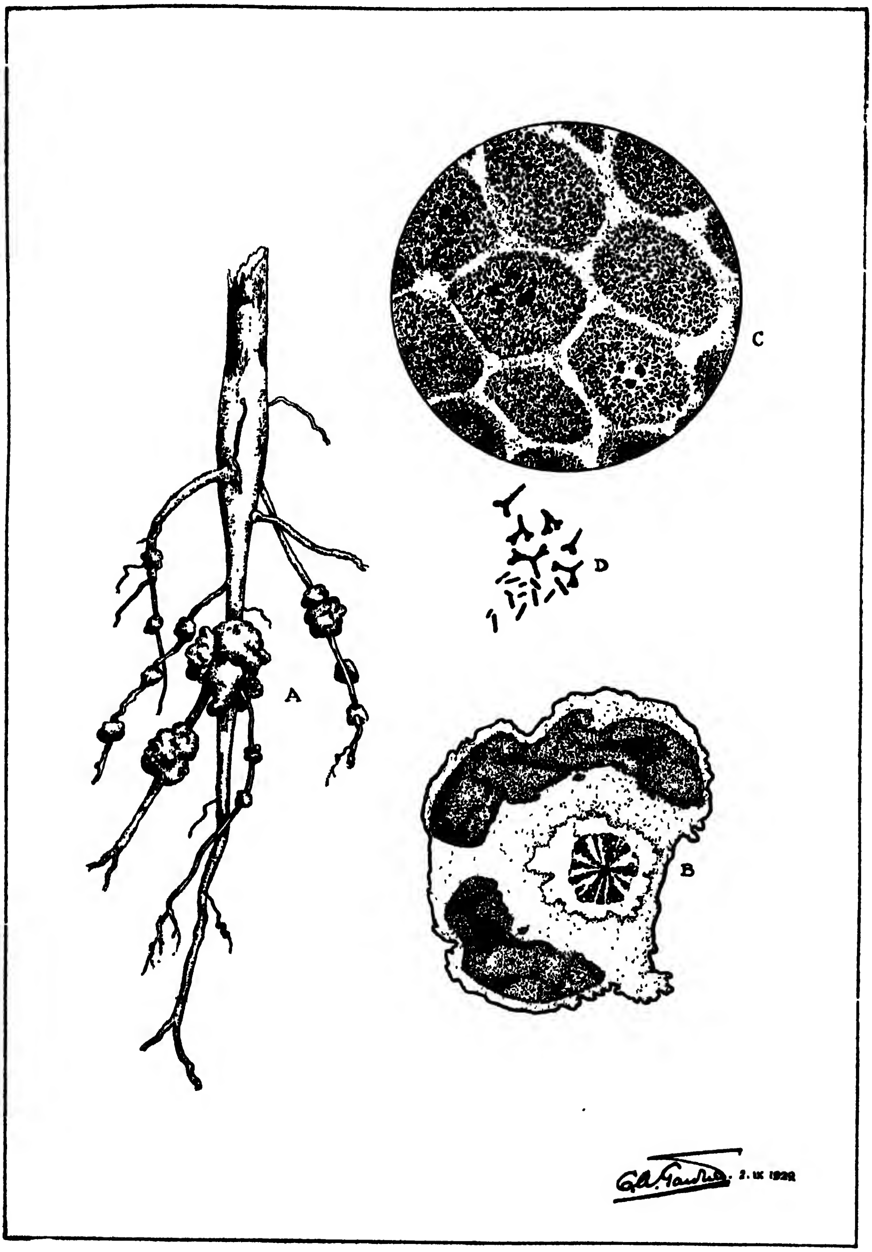


Fig. 1.—Nitrogen-fixing bacterial nodules on the root system of W.A. Blue Lupin plant (*Lupinus varius L.*)

a, Root system showing bacterial nodules (half natural size); b, Section through nodule (much enlarged), showing two darkly-shaded zones containing bacterial colonies; c, nitrogen-fixing bacteria in the plant cells; d, Branching and rod forms of nitrogen-fixing bacteria; (c and d taken from G. T. Moore, from Harshberger, "Mycology and Plant Patholgoy."). (*After C. A. Gardner, this Journal, Sept.* 1929.)

milk for every *eight-ounce medicine bottle*, of culture. Into the skim milk mix the powdered calcium phosphate supplied with every bottle of culture (3.0 gm. for each *two-ounce bottle*, 12.0 gm. for each *eight-ounce bottle*).*

Then transfer the whole of the agar contents of the bottle to the skim milk and *thoroughly* mix the bacterial slime with the milk. This may be done by pouring a little of the milk into the bottle and shaking vigorously and then pouring back into the rest of the milk. Repeat this procedure several times. When this has been done, pick out the lumps of agar (*i.e.*, the solid, whitish, jelly-like material), which will probably have become broken up into small pieces by the repeated shaking.

Now inoculate the seed by pouring a little of the inoculated milk on the heap of seed from time to time, and thoroughly mixing until every seed is moistened. The seed should not, however, be made too wet. If any of the inoculated skim milk is left over it should be mixed up with water and spread on a few yards of soil where the seeds are to be planted. On the other hand, if there is not quite enough inoculated milk to thoroughly moisten all the seeds, the vessel which formerly contained the inoculated skim milk may be rinsed out with further skim milk, and more added to the heap of seeds, until, on repeated mixing, every seed is uniformly moistened with the inoculated milk.

If sweet skim milk is not available, a commercial brand of powdered skim milk mixed up with water according to the maker's directions, or even plain water may be used instead. The milk is better, however, as it causes better adherence of the bacteria to the seed on drying.

It usually takes about one half-pint of milk to every 20 or 30 lbs. of small seeds such as lucerne, or 40 to 60 lbs. of large seed such as peas. The larger the seeds the less culture and skimmed milk required for inoculation, and *vice versa*.

SOWING.

The seeds should be sown as soon as possible after inoculation. If the seeds are too wet to sow they should be allowed to dry in a *cool shady* place. Under no circumstances should the cultures or the inoculated seeds be left exposed to the sunlight, as it tends to destroy large numbers of the bacteria. For this reason, also, the seed should be drilled, or, if broadcast, should be at once harrowed in. *The inoculated seed should not be sown at the same time as artificial fertilisers,* unless the fertilisers and inoculated seeds are run through separate drills or separate "runs" of the same drill, or are in some other way separately applied to the land, as the bacteria may be destroyed if in contact with the raw fertilisers for any length of time before reaching moist soil. If the seed is very small it may be mixed with bran, or soil, etc., for greater evenness of sowing through a drill. If the soil is moist at planting time, the inoculated seed may safely be run through the seed box, and the fertiliser from the fertiliser box of the same drill as the seed and fertiliser will only be in contact for a very short time before reaching the moist soil. Such a procedure is not permissible, however, if the soil is dry. Where possible, the safest plan is to sow the fertiliser in moist soil one day, and the inoculated seed a day or two later.

* The original directions received from Rothamsted (see Appendix I.) called for the use of water-soluble calcium phosphate in considerably smaller amounts than those indicated above. As this is not obtainable (as such) from the local druggists the powdered tricalcium phosphate P.B. has been used instead.

WARNING—THE CULTURES ARE NOT A CURE-ALL.

Growers are warned that the *only* function of the nitrogen-fixing bacterial cultures—although an exceedingly important and valuable one—is to enable leguminous plants to make free use of the inexhaustible supplies of gaseous nitrogen in the air.

Without the presence of bacterial nodules the leguminous (pea family) plants, and indeed all other plants, find themselves, so far as this uncombined nitrogen is concerned, in somewhat the same situation as the sailors in Coleridge's story of the *Ancient Mariner*,—"Water, water, everywhere, nor any drop to drink."

Nitrogen is an essential food material for all plants. By most species, however, it can only be obtained, in spite of its very great abundance in an uncombined form in the atmosphere (*see* footnote to the second page of this article), in the form of compound substances (nitrates, urea, ammonium carbonate, etc.). Such compound nitrogenous substances are formed in the soil as a result of the decomposition of organic matter (plant or animal matter) or from such artificial fertilisers as sulphate of ammonia, nitrate of soda, ammonium phosphate, and so on.

Where other kinds of plants would fail to thrive because of a deficiency of combined nitrogen in the soil, legumes may succeed splendidly, provided they are equipped with nitrogen-fixing bacterial nodules on the roots.

These nodules *cannot*, however—

(1) Take the place of good drainage.

(2) Remove salt from the soil.

(3) Provide other necessary food materials such as lime, phosphoric acid, or potash.

(4) Prevent plant diseases or insect pests; and so on, as some farmers in the past appear to have imagined.

CONCLUSION.

Where combined soil nitrogen is the limiting factor in the growth of crops it can be provided most cheaply by the growing of leguminous crops from inoculated seed, and by the feeding off *in situ* or ploughing under of such plants before other crops are sown. The bacterial cultures have no mystical properties, however, and can do nothing else but supply nitrogen to the legumes in the cheapest possible way.

It may be mentioned here that it will often be found of great value in the successful establishment of leguminous crops to broadcast approximately one or two tons of freshly slaked lime per acre several months before sowing the seed. The lime will remove soil acidity (sourness), improve the physical, chemical, and biological properties of the soil, and greatly stimulate the development of the nitrogen-fixing bacteria.

USERS ASKED TO REPORT RESULTS OBTAINED FROM THE USE OF THE CULTURES.

It would be greatly appreciated if persons using the cultures would sow several rows of uninoculated seed before opening the bottle, or bottles, and then subsequently plant the inoculated seed alongside, using the same fertiliser, etc., and report any differences in growth or yields, etc.

APPENDIX I.

History of the Distribution of Nitrogen-Fixing Bacterial Cultures in W.A.

In 1926 this Department obtained a pure culture of the lucerne root organism (*Rhizobium radicicola*), from the Rothamsted Experiment Station, England, on the initiative and through the good offices of Mr. F. W. Strack, General Manager of the Primary Producers' Bank of Australia, London, England.

This organism was subcultured and distributed to farmers in various parts of the State by the then Botanist and Plant Pathologist, Mr. W. M. Carne, with the result that successful stands were obtained in many places where success with this crop had previously not occurred. The same strain has been grown on artificial media ever since, and is still being distributed to farmers in this State, who are using it with great success.

With the passage of time, nitrogen-fixing bacteria for other kinds of leguminous plants have gradually been acquired from various sources. Wherever farmers have planted uninoculated seed alongside inoculated, they have almost invariably reported an enormous difference in favour of the treated seed.

This is readily understandable, as Western Australia and particularly the extreme South Western portion of it, is agriculturally very young, so that in nearly every instance leguminous crops are planted on soil which has not previously grown the same crop or a crop carrying the same kind of organism on its roots. In many cases burnt-over forest country or newly-cleared land is planted so that it is just as necessary to introduce the appropriate bacteria from an outside source, as to introduce the seed of the crop itself

By the use of the cultures it has been found that a good stand of subterranean clover, for example, may be obtained in the first year from clean machined seed, whereas from similar seed in the ordinary way a satisfactory stand does not usually result on new ground until the third or fourth season after sowing.

The following extracts have been taken from Annual Reports of the Plant Pathologist from 1928-9 onwards. No information is given in the reports for 1926-7 and 1927-8 as to the numbers of cultures sent out to farmers during those periods.

Annual Report, Plant Pathologist, 1928-9.

"Distribution of lucerne root bacteria, 37 test tubes. In connection with the distribution of lucerne-root bacteria, farmers in the Group Settlements, etc., who have availed themselves of the cultures when establishing lucerne beds have expressed great satisfaction at the results."

Annual Report, Plant Pathologist, 1929-30.

"Distribution of lucerne-root bacteria	134 test tubes.
Distribution of soy bean-root bacteria	42 test tubes.
Distribution of pea-root bacteria	16 test tubes.
Total	192

"In addition to the continued and increasing distribution of tubes of lucerne-root bacteria, the branch is now in a position to supply farmers with appropriate nitrogen-fixing bacteria for inoculating the seeds of peas, clovers or soy beans before sowing.

"The clover and pea bacteria were obtained from the Urbana Laboratories, Urbana, Illinois, U.S.A., through the courtesy of Mr. A. T. O'Connell, Dwarda, who was having great difficulty in the successful establishment of field and Tangier peas prior to the importation of the pea culture.

"During the autumn months Westralian Farmers, Ltd., imported considerable quantities of soy bean seeds for distribution in small parcels to farmers for experimental purposes. As the soy bean will only make satisfactory growth when inoculated with a particular strain of the nitrogen-fixing organism *Rhizobium radicicola*, arrangements were entered into whereby the Branch agreed to supply any farmers purchasing the seed with the requisite organisms at the price of 1s. per tube. This sum barely covers the cost of materials and postage.

"The original soy bean culture was supplied by Westralian Farmers." (Subsequently, in 1933, a second soy bean culture was forwarded to this Department with soy bean seed, by the Ford Motor Co., of Canada.)

Annual Report, Plant Pathologist, 1930-31.

"Distribution of nitrogen-fixing bacterial cultures:—

Lucerne	34 test tubes	5 (8 oz.) bottles
Peas	29 "	34 "
Soy Beans	46 "	—
W.A. Blue Lupins	8 "	23 "
Clover	10 "	9 "
Total	127 "	71

Grand Total—198.

"This Branch is at present supplying nitrogen-fixing bacterial cultures to farmers for inoculating peas, clovers, lucerne, soy beans or W.A. blue lupin at a nominal charge of 1s. 6d. for a tube containing sufficient to inoculate 15 lbs. of small seeds such as lucerne, or 30 lbs. of larger seeds such as peas. The medicine bottle size for 2s. 6d. contains sufficient to inoculate about 120 lbs. of small seeds such as lucerne and 240 lbs. of large seed such as peas.

"These cultures have been greatly appreciated by the farming community, and following an article by the writer in the March issue of the 'Agricultural Journal' for 1931, the demand for them became so great that considerable difficulty was experienced in keeping the supply up to it. The W.A. blue lupin organism was isolated in this laboratory by Mr. H. G. Elliott."

Annual Report, Plant Pathologist, 1931-32.

"Nitrogen-fixing bacterial cultures:—

	2 oz. bottle. size.	8 oz. bottle size.
(a) Lucerne	110	13
(b) Peas	16	35
(c) Soy Beans	3	1
(d) W.A. Blue Lupins	2	5
(e) Clovers	6	6
(f) Miscellaneous	20	—
	157	60

Grand Total—217."

Annual Report, Plant Pathologist, 1932-33.

"So successful have been the results obtained by farmers in the establishment of leguminous crops such as subterranean clover, lupins, lucerne, Tangier peas, etc., during the first year on new land by the inoculation of the seed before planting, that the demand for the pure cultures supplied by this laboratory continues to increase, some 270 odd having been prepared and supplied during the past year. During this period the organisms required for the inoculation of sulla (*Hedysarum coronarium*) and cow peas (*Vigna sinensis*) were isolated in pure culture in this laboratory. The sulla organism was isolated by Miss J. Hearman and the cow pea organism by Mr. B. Williams. The French bean organism was obtained by courtesy of the N.S.W. Department of Agriculture. The following table shows the number of each kind of culture supplied during the year:—

	Size 2 oz. medicine bottle.	Size 8 oz. medicine bottle.
Lucerne	140	12
Clover	28	12
W.A. Blue Lupins	5	14
Peas	37	16
Cow Peas	2	1
Sulla	0	0
Soy Bean	5	0
French Bean	1	0
	218	55

Grand Total—273.

This represents an increase of 56 cultures over our previous record of 217 in 1931-32."

Cultures from 1st July, 1933, to November 28th, 1933.

	Size 2 oz. medicine bottle.	Size 8 oz. medicine bottle.
Cow Pea	189	7
Lucerne	40	7
Soy Bean	11	0
Peas	23	15
Clover	2	0
French Bean	5	0
Sulla	1	0
W.A. Blue Lupin	1	0
	272	29

Grand Total—301.

APPENDIX II.

Preparation of Legume Root-Soy Bean Agar for Growth of Nitrogen-fixing Bacteria.

The method of preparation of agar media for the growth of nitrogen-fixing bacteria in this laboratory, which has been used with great success since 1930, is given below for the sake of workers in other laboratories who may be interested.

The formula is a modification of that originally received from the Rothamsted Experiment Station, England, with our first lucerne culture. All the organisms listed above as being supplied to farmers, are grown on the same agar with great success.

The soy beans were first introduced into the formula when our first soy bean culture was received, and we were unable to obtain any soy bean roots. So vigorous was the growth made by all the strains of the organism as a result of the modification, that soy beans have been used in making up the agar ever since. When the sulla organism was first isolated, it did not seem to be able to grow on this agar and was grown for a time on agar similarly prepared except that sulla roots were used instead of the lucerne, trefoil or "Hexham Scent" roots normally used. Now, however, it grows quite well on our usual agar.

To Prepare Legume Root-Soy Bean Agar for the Growth of Rhizobium Radicicola.

Take 50 gms. well washed roots of lucerne (*Medicago sativa*), or burr trefoil (*Medicago denticulata*) or "Hexham scent" (*Melilotus indica*) (or mixtures of these). Burr trefoil roots give the most vigorous growth on the whole, followed by "Hexham scent" and then lucerne. Add 10 gms. soy beans. Mince well in meat mincer or chop up finely. Add three times the volume of water. Boil one hour, and then stand 24 hours. Filter through cotton wool and make the extract up to 1,000 ccs. Add the following chemicals:—

Dipotassium monohydrogen phosphate	1.0	gm.
Magnesium sulphate	0.2	gm.
Sodium chloride	0.1	gm.
Calcium chloride	0.1	gm.
Ferric chloride (2 drops concentrated solution)	0.02	gm.
Agar—		
In Winter	20	gms.
In Summer	25	gms.

Dissolve the agar by autoclaving. Filter through cotton wool and add—

Calcium carbonate	5	gms.
Sucrose	10	gms.

Keep the agar well agitated by constant movement of the flask so as to ensure even distribution of the calcium carbonate.

Pour into medicine bottles, etc., sterilise 20 minutes at 15-20 lbs. pressure and slope.

KOJONUP PASTURE COMPETITION, 1933.

A. S. Wild,
Agricultural Adviser.

The 5-acre pasture competition conducted by the Kojonup Agricultural Society in 1933 was divided into two sections. Of these No. 1 Section was for competitors whose properties are located in portions of the district enjoying a higher rainfall—probably about 2 inches more than that of Kojonup townsite—and No 2 Section for that portion of the district nearer Kojonup.

The rainfall as recorded at Kojonup from April to October is as hereunder:—

April.	May.	June.	July.	August.	Sept.	October.	Total growing period.
62	238	652	231	407	227	256	20.73 inches.

The inspection of the competing pastures was made about November 6th, the awards being made as follow:—

Section 1.

Competitor.	Yield. 40 pts.	Freedom from Weeds. 15 pts.	Useful Grasses. 15 pts.	Freedom from Disease. 15 pts.	Evenness of Growth. 10 pts.	Total. 100 pts.
Cassey, P.	36	14	14	13	9	86
Cavanagh, M. F. ...	36	13	13	14	9	85
Roche, H. L. ...	30	13	12	13	8	76
Lewis, G. N. ...	25	13	13	13	7	71

Section 2.

Competitor.	Yield. 40 pts.	Freedom from Weeds. 15 pts.	Useful Grasses. 15 pts.	Freedom from Disease. 15 pts.	Evenness of Growth. 10 pts.	Total. 100 pts.
Partridge, A. W. ...	27	14	14	13	8	76
Milne, D.	22	13	12	13	7	67

First place in Section 1 was awarded to Mr. P. Cassey's entry, a pasture composed chiefly of subterranean clover and Wimmera rye grass.

The land had originally carried jarrah and white gum timber and had been cleared, ploughed and planted in 1930. Subterranean clover had been sown at the rate of 1½ lbs. per acre and superphosphate applied at 90 lbs. per acre. During each of the succeeding years 90 lbs. of superphosphate per acre were applied as a topdressing in the early part of the season. During this year an additional 90 lbs. dressing was applied in August. The pasture had been stocked this year during the early part of the season only.

Mr. M. F. Cavanagh's entry had been established about 12 years previously on red gum, white gum and flooded gum country. The fallowed land had been planted with oats and 1 lb. of subterranean clover per acre. At various times since it had been topdressed with 90 lbs. of superphosphate per acre applied in April. This dressing was applied in 1931 but not in 1932, while in 1933 two dressings, each of 90 lbs., were applied in May and August respectively. This year the pasture had been stocked up to the middle of June.

Mr. H. L. Roche's competition pasture was also on land which had originally carried red gum, white gum and flooded gum timber. The land, which had been cleared for many years, was ploughed about 1926 and planted with oats and 1 lb. of subterranean clover per acre. Superphosphate was applied at 90 lbs. per acre, this amount being reduced to 70 lbs. for the succeeding annual topdressings each April. During 1933 an additional 90 lbs. topdressing was applied in August. This pasture was fairly heavily grazed up to the end of June.

No information concerning the early history of Mr. G. N. Lewis's pasture plot was available. The original timber was red gum and blackboys which had been cleared many years ago. Two topdressings, each of 70 lbs. of superphosphate per acre, were applied in 1931, and one of 56 lbs. in 1932. The pasture also received two dressings (each of 70 lbs. per acre) during 1933, one applied in April and the other in August. It had been stocked up to late September.

Mr. A. W. Partridge's entry, which was awarded first place in Section 2, was a very fine pasture composed chiefly of subterranean, drooping flower and crimson clovers, soft brome and fine grasses, and some hop and yellow suckling clovers. It had been established on land which had been cleared of its jam, sheoak, and red gum timber in 1930. During the same year it was ploughed and planted with oats and a mixture of clover seeds. Of these, subterranean clover was planted at 2 lbs. per acre, crimson clover at ½ lb., and drooping flower clover at ¼ lb., with superphosphate at 90 lbs. per acre. This application of fertiliser has been repeated in April and again in August during each of the succeeding years. This pasture, which was a very fine entry, had been stocked up to the end of September.

The pasture plot entered by Mr. D. Milne had been established in 1927 on jam, sheoak, white gum and flooded gum country which had been cleared for many years. The fallowed land had been planted with oats and 1 lb. of subterranean clover per acre, together with a dressing of 90 lbs. of superphosphate. This rate of application of the fertiliser had been continued for the three succeeding years and then after 1930 reduced to 60 lbs., applied in April. During 1933 this was supplemented by an additional 60 lbs. applied in August. The pasture had been heavily stocked up to the middle of August.

The entries inspected in Section 2 would have shown to better advantage if inspected a few days earlier, as they were affected by the warm, dry weather conditions.

However, all the pastures of both sections were of a high standard, some being calculated to yield up to 13 tons of green fodder per acre.

CHEMICAL WEED KILLERS.

The Chlorates of Sodium and Calcium.

G. R. W. MEADLY, B.Sc.,
Botanical Branch.

From time to time various chemicals have been used in attempting to eradicate weeds. Common salt applied in comparatively large quantities, has met with some success, but the soil does not recover its productive powers for a considerable time after application. Copper sulphate (bluestone), iron sulphate, and sulphuric acid have been employed, usually in weak solutions, mainly for the destruction of weeds such as charlock in crops. Sulphate of ammonia has proved quite effective in checking weeds, particularly clovers in lawns. Sodium arsenite is quite a useful plant poison, particularly for killing green timber after ringbarking. Its definitely poisonous character to animals, however, is one factor which prevents its general use for weed destruction. Various refuse oils and waste products from gas works, etc., have been used with varying degrees of success.

Weedicides which have come under notice during recent years are arsenic pentoxide and the chlorates of sodium and calcium. New Zealand experiments by Levy and Madden (1) showed that arsenic pentoxide is appreciably selective in its action, when applied to lawns at a strength of 1-80, *i.e.*, 1 lb. to 8 gallons of water, at the rate of about 240 gallons per acre, a good kill of weeds is recorded associated with a browning, but comparatively quick recovery of the grasses.

Sodium and calcium chlorates have received particular attention during the last few years, and besides being sold commercially under these names, are included to a greater or lesser extent in a number of trade preparations. One of the first experiments carried out in America demonstrated that Johnson grass could be successfully controlled by the application of a 10 per cent. solution of sodium chlorate in spring followed by a further spray in summer, to kill any plants which may have survived the first application. Since then, very promising results have been obtained with sodium chlorate on such serious weeds as Field Bindweed (*Convolvulus arvensis*) (W. L. Latshaw and J. W. Zahnley) (2), Ragwort (*Seneceo Jacoboea*) (J. W. Deem) (3) and (4), Blackberry (*Rubus fruticosus*) (3), Californian Thistle (2), Gorse (*Ulex europaeus*) (3), Creeping Buttercup (*Ranunculus repens*) (5).

In our local experiments and most of those carried out in other parts of the world sodium chlorate has proved more satisfactory than calcium chlorate. It is a white crystalline substance which is readily soluble in water, but when applied to vegetation, unlike most other weedicides, some time elapses before any changes are apparent. The supposed action when a plant is sprayed, is for the solution to pass into the leaves through the stomata and then proceed down the conducting portion of the leaves and stems to the roots. Examinations made of Bindweed roots (2) showed that normally the cells were filled with starch granules and the cell walls were intact. On the other hand, roots from the plants treated with sodium chlorate were characterised by the absence of starch granules and the cell walls in many cases showed unmistakable signs of disintegration.

Just why sodium chlorate affects the plants as it does is not known. Observations indicate that it interferes with photosynthesis, the building up processes, and compels the plant to draw upon the food reserve in the roots, until the supply is exhausted and death occurs.

RESULTS OF EXPERIMENTS.

1. Commercial calcium chlorate.—On 20th January, 1931, small areas in the Plant Introduction plots at Perth were sprayed with 5 per cent., 10 per cent., and 15 per cent. solutions of commercial calcium chlorate, using a fine spray and applying until the foliage of the plants was completely covered. The main plants present were:—

Anagallis spp. (Pimpernel).
Chenopodium ambrosioides (Ant weed).
Cynodon dactylon (Couch Grass).
Digitaria marginata (Summer Grass).
Echinochloa colona (Barnyard Millet).
Medicago denticulata (Burr Trefoil).
Melilotus indica (King Island Melilot).
Nasturtium officinale (Water Cress).
Paspalum dilatatum (Paspalum).
Plantago major (Rib Grass).
Polygonum aviculare (Wire Weed).
Polypogon monspeliensis (Beard Grass).
Portulaca oleracea (Purslane).
Ricinus communis (Castor Oil).
Rumex spp. (Docks).
Solanum nigrum (Nightshade).
Sonchus oleracea (Milk Thistle).
Stellaria media (Chickweed).
Villarsia spp (Wild Violet).
Cyperus spp. (Nut Grass, etc.).

Although at the end of the first day after spraying several plants, particularly Nightshade and Docks, were showing decided signs of wilting, with the exception of the 15 per cent. portion the majority of the plants recovered. The 5 per cent. was of little or no use; the 10 per cent. produced a drying effect, killing a few of the less hardy plants, whereas the 15 per cent. apparently destroyed a number of plants, the young Nut Grass in particular being affected.

Further experiments were carried out with 15 per cent. solution on blackberries at Jarrahdale. Although at the end of the first week the leaves were considerably shrivelled, the plants soon recovered and produced normal shoots.

From the results obtained it is evident that commercial calcium chlorate is not particularly satisfactory as a weed killer, for even when using a 15 per cent. solution the results obtained were not impressive.

2. Sodium chlorate.—A corresponding series of experiments were carried out using varying concentrations of sodium chlorate. On the experimental plot it was found that a 5 per cent. solution, in general, was sufficient to kill the Castor Oil plants. With this strength some of the Nightshade recovered, but with 10 per cent. and 15 per cent. solutions the Nightshade, Nut Grass, and majority of other weeds were apparently killed. The 15 per cent. produced more marked results than the 10 per cent. and a greater drying effect was noted.

Five per cent., 10 per cent., and 15 per cent. solutions were used in spraying Blackberries at Jarrahdale. The 15 per cent. solution was first used (5th February), and in a fortnight all the leaves were dried and the branches were also wilting back considerably. Five weeks after application a very limited number of green leaves were evident (12 March), and the plants were then burned.

Three weeks after spraying with 5 per cent. and 10 per cent. solutions the plants were wilted back, apparently to the same extent as with the stronger solu-

tion, and no new shoots were evident. This effectiveness of the weaker solutions may be due to the slower wilting produced in the leaves and consequently the increased opportunity to take in more of the solution before plasmolysis occurs.

The burning gave the plants a further set back and the dead stems were slashed away. A few shoots which appeared later were sprayed with a 10 per cent. solution, which in most cases gave complete control. Observations indicated that if the dry stems are burned at all, the burning should not take place until the chlorate has had every opportunity to produce maximum results. This time would vary with different plants and under different conditions, but should not be less than one month.

Similar results have been obtained with Blackberry in the Eastern States and New Zealand, but in order to meet with reasonable success the work must be carried out thoroughly and when conditions are most satisfactory.

Local experiments with Cape Tulip (*Homeria collina* and *H. miniata*) have not proved very satisfactory, the best results having been obtained with a 10 per cent. solution. The leaf surface is comparatively smooth and hard, thus not tending to retain the spray. The time of spraying is particularly important, owing to the formation of bulbils around the main corm and also in the axils of the leaves. If spraying is not carried out before their formation and separation the reduction brought about by killing the old plant is not very appreciable. Formation of bulbils usually commences about the middle of August. Cape Tulip has been eradicated in South Australia by sodium chlorate spray (6).

Couch grass is severely burned by a 15 per cent. solution, but a large percentage usually recovers if general growth conditions are favourable, and further applications are therefore necessary. If spraying is repeated sufficiently, eradication may be secured, but the limiting factor is the cost of the material when considered from a practical viewpoint.

METHOD OF APPLICATION.

Calcium and sodium chlorate may be applied either as a solution or in the crystalline form. Generally the spray method is more efficient and less material is required although labour is more expensive (4).

When using in the dry form it is advisable to employ a spreader, and when carbonate of lime can be procured at a reasonable price it is the best to use. Any material, however, so long as it is dry and fine enough and does not contain any organic or sulphurous matter, is suitable. The dissolving of sodium chlorate in water and then spraying on to the spreader would appear to be the easiest and most effective method of mixing for dry purposes.

When a solution is used the leaf surface should be completely covered with a fine spray, while when using the dry material a complete dusting should be given. If not too numerous the crowns of perennial herbs should be injured before dusting.

TIME OF APPLICATION.

It is generally accepted that the most suitable time to apply the sprays is when the plants are in full bloom, the application being made in sunlight. Action is more rapid when the air is moist, and rain following a short time after spraying does not hinder the action, and in some instances the kill has been more complete when rain followed a few hours after spraying. Seeds are not readily destroyed by the spray, which should therefore be applied prior to seed formation. Thus the optimum period of attack is rather limited.

The increased effectiveness of the treatment as the plants approach maturity may be attributed to the more fibrous nature and the ease of dissemination of the chemical through the rooting system.

Treatments are considered more effective if the water table is more or less stationary or slightly lowering at the time of application.

It is not advisable to attempt spraying in the winter, and cultivation prior to application of chlorates is not recommended.

STRENGTH OF SOLUTION.

Naturally the strength of solution required, varies with the type of weed and stage of growth when applied. Most soft, shallow rooted annual weeds are destroyed by a 2½ per cent. solution (¼ lb. to one gallon water), but for general use a 10 per cent. solution (1 lb. to 1 gallon water) is most satisfactory. For average weed infection about 100 gallons per acre is sufficient for a single spraying, but in the case of blackberry thickets, etc., as much as 500 gallons and even more may be required. When applying crystals instead of spraying, larger quantities of material are required, but the expense of application is not so great. As an example in New Zealand experiments on Ragwort (4), better results were obtained with 24 lbs. per acre of sodium chlorate sprayed in the form of a 5 per cent. solution than with 28 lbs. broadcasted in the dry state with 5 cwt. of lime as a spreader

SPRAYING APPARATUS.

For general use a knapsack sprayer of about three gallons capacity is the most serviceable. This should be fitted with a trigger spray to prevent waste. The nozzle should produce a very fine spray so as to enable the whole leaf surface to be covered without undue loss of material.

When large areas are to be treated a power spray is essential. In America these are almost always mounted on motor trucks as shown by the photographs taken from an article by Ball, Madson & Robbins (7).

EFFECT ON SOIL AND TREES, ETC.

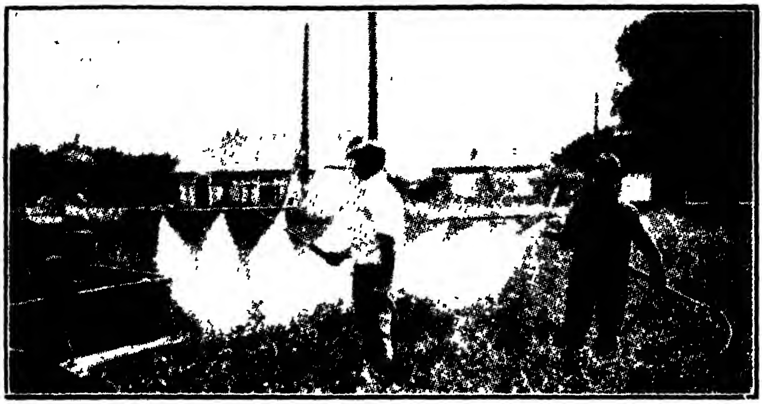
Sodium chlorate, when used for spraying weeds, has only a temporary injurious effect of the soil, affecting crops sown very soon after spraying. The period which must elapse before it is safe to sow crops will largely depend on the amount of rainfall subsequent to spraying. The surface soil generally becomes entirely free of the substance in three to eight months, and crops can be safely sown during the season succeeding the application.

Some authorities state that only light applications should be made in orchards; others have found that two or three sprayings of 100 lbs. per acre can be safely used to kill Bindweed growing round trees and shrubs. Deep rooted trees are certainly not likely to be injured by chlorates applied around them (8). It has been shown that the process of nitrification in the soil is temporarily retarded by the application of this spray (8).

POISONOUS PROPERTIES.

Work carried out by Seddon and McGrath (9) definitely proved that sodium chlorate is toxic to stock if ingested in sufficient quantities, but as it is generally used as a 10 per cent. solution and usually sprayed lightly over vegetation, it would seem unlikely that sheep or cattle would eat sufficient of the sprayed vegetation to do harm. J. W. Deem (3) recorded cows eating quantities of thistle tops with apparent relish and no ill effects, a few days after they had been sprayed. During our own tests on blackberries at Jarrahdale, cattle were grazing in the paddock while the spraying was being done, apparently with no adverse results.

Probably the greatest danger would arise through leaving bags of sodium chlorate or mixed solution where stock would have access to it, although to eliminate all risk stock may be removed from the treated areas.



Power spray rig, showing two lines of hose with multiple nozzle.

Power spray rig, built for roadside spraying. Will spray a strip 15 feet wide. Capacity, 900 gallons.

Power spray equipment adapted for spot work along roads. Two lines of hose.

[From California Agricultural Extension Service—Circ. 54.]

DANGEROUS PROPERTIES.

Sodium and calcium chlorates are strong oxidising agents and easily inflammable when dry, so that users are advised to thoroughly wash clothing that may become saturated with the solution during spraying operations. When working with these substances it is advisable to wear rubber shoes, as ordinary leather becomes saturated with the solution.

All apparatus in which the chemicals have been used should be thoroughly cleaned by rinsing several times in water. Clothing, straw or chaff mixed with the solution and permitted to dry may be ignited by friction or a spark. While quite safe to handle by themselves these chlorates form explosive mixtures with a number of other substances such as strong acids, sulphur and sugar. This should be remembered if spreaders are added at any time to aid an even distribution.

Although several painful accidents have occurred in New Zealand and America, if reasonable care is exercised with sodium and calcium chlorates no trouble should be experienced.

CONCLUSIONS.

Sodium chlorate has definitely proved superior to calcium chlorate in most trials which have been carried out. If applied often enough there are evidently few weeds which it will not kill, but the price of material is a decided limiting factor from a practical viewpoint. Chlorate sprays will rarely prove profitable on appreciable areas containing weeds which may be eradicated by cultivation. Their use in the eradication of poison plants such as York Road Poison (*Gastrolobium calycinum*) and Box Poison (*Oxylobium parviflorum*) is not recommended.

Although trials with sodium chlorate, both locally and in other parts, have proved to a large extent very successful, it must be remembered that thoroughness is essential in order to obtain satisfactory results. Care in completely mixing solutions, applying in a fine spray at the correct stage of growth and under suitable conditions must all be considered when attempting the eradication of weeds with chlorate sprays.

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FERTILISERS.

N. DAVENPORT,
Inspector of Fertilisers.

A new fertiliser year for the State commenced on 1st November last, and in accordance with the provisions of the Fertilisers Act, 1928, the current registrations (effected to 1st December) are appended in tabular form.

From the retail prices per ton, and the registered percentages of the various fertilising ingredients present in the fertilisers, the unit values for the different forms of nitrogen, phosphoric acid, and potash have been calculated and are shown below, together with those of 1932 and 1933 for comparison.

The main variations from last year's figures are, a reduction of 3d. per unit in the water and citrate soluble forms of phosphoric acid and a rise of 1s. 4d. per unit for ammoniacal nitrogen, as sulphate of ammonia. The unit cost of nitrogen in blood and bone and bonedust has fallen 1s., and for the same class of fertilisers the phosphoric acid has been reduced 3d. and 9d. per unit respectively.

The prices of potash have remained constant.

UNIT VALUES.

	1932.	1933.	1934.
	s. d.	s. d.	s. d.
NITROGEN (N) as			
Blood and Bone, Bonedust and Bone and Flesh ...	24 0	24 0	23 0
Nitrate ...	20 3	19 10	19 11
Ammonia ...	12 6	11 0	12 4
PHOSPHORIC ACID (P_2O_5) as—			
Water Soluble ...	4 2	4 2	3 11
Citrate Soluble ...	4 2	4 2	3 11
Acid Soluble in Bonedust ...	6 6	6 6	5 9
„ „ Blood and Bone, and other animal fertilisers ...	5 6	5 6	5 3
Basic Phosphate ...	5 6	5 6	5 6
Superphosphate and Rock Phosphate ...	2 6	2 6	2 6
POTASH (K_2O) as—			
Sulphate ...	7 4	8 5	8 5
Muriate ...	5 8	6 7	6 7

The following fertilisers have been registered at the Department of Agriculture under the Fertilisers Act, 1928, for the year commencing 1st November, 1933:—

Name of Fertiliser.	Brand.	By whom Registered.	Nitrogen (N) as: Nitrate.	Nitrogen (N) as: Ammonia	Nitrogen (N) as: Blood & Bone.	Nitrogen (N) as: Bone-dust.	Phosphoric Acid (P_2O_5) as: Water Soluble.	Phosphoric Acid (P_2O_5) as: Citrate Soluble.	Phosphoric Acid (P_2O_5) as: Acid Soluble.	Phosphoric Acid (P_2O_5) as: Total.	Potash (K_2O) as: Sulphate.	Potash (K_2O) as: Muriate.	Price per ton on rails at Works or Perth.
A.—MINERAL.													
1.—NITROGENOUS.			%	%	%	%	%	%	%	%	%	%	£ s. d.
(a)—Nitrogen as Nitrate.													
Nitrate of Soda	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	15·5	...	..	..		..	..	...	...	...	15 4 0
Do.	ML in diamond ...	do. do ...	15·5										
Do.	C.S.M.L.	do. do. ...	15·5	..	..	..	...	.	..	...	...	...	15 4 0
Do.	Cresco	Cresco Fertilisers (W.A.), Ltd.	15·0		..	.	.	...	..	...	...	...	15 14 0
(b)—Nitrogen as Ammonia.													
Sulphate of Ammonia ...	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	..	20·5	.	..		..	...	...	..	..	12 12 0
Do.	ML in diamond ...	do. do. ..	..	20·5	.	.	.	...	..	...	...	...	12 12 0
Do.	C.S.M.L.	do. do. ...	..	20·5	...	..	..	...	..	...	...	...	12 12 0
Do.	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	20·0	..	.	..	...	...	...	...	...	12 12 0
Do.	ICI in circle ...	F. Viles	..	20·6	..	..	...	...	...	...	...	...	12 12 0
2.—PHOSPHATIC.													
(a)—Rock Phosphates.													
Pacific Island Phosphates ...	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	..	..	..	...	...	36·65	36·65	...	...	4 10 0
Do. do. ...	ML in diamond ...	do. do. ...	..	...	...	...	...	...	36·65	36·65	...	...	4 10 0
Do. do. ...	C.S.M.L.	do. do. ...	...	.	...	..	...	...	36·65	36·65	...	...	4 10 0
Phosphate Powder	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	...	...	...	34·80	34·80	...	...	4 10 0
(b)—Superphosphates.													
Florida Super. (22)	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	...	..	..	20·5	·5	1·0	22·0	...	...	4 5 0
High Grade Super. (22) ...	ML in diamond ...	do. do. ...	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 5 0
High Grade Super. (22) ...	C.S.M.L.	do. do. ...	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 5 0
22 Super.	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	..	...	..	20·5	·5	1·0	22·0	...	...	4 5 0
Florida Super (24)	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 10 0
High Grade Super (24) ...	ML in diamond ...	do. do. ...	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 10 0
High Grade Super. (24). ...	C.S.M.L.	do. do. ...	...	...	..	...	22·0	·5	1·5	24·0	...	...	4 10 0
24 Super.	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 10 0

(c)—Rock Phosphate and Superphosphates.													
Phosphate Mixture (50/50)	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.					10·0	1·0	18·0	29·0	...	...	4 11 6
Do. do. ...	ML in diamond ...	do. do. ...					10·0	1·0	18·0	29·0	...	...	4 11 6
Do. do. ...	C.S.M.L.	do. do. ...					10·0	1·0	18·0	29·0	...	...	4 11 6
50/50 Phosphate	Cresco	Cresco Fertilisers (W.A.), Ltd.					9·16	1·84	17·4	28·4	...	...	4 10 0
(d)—Basic Phosphates.													
Basic Phosphate	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.					...	...	17·0	17·0	...	...	4 14 0
Do.	ML in diamond ...	do. do. ...					...	...	17·0	17·0	...	...	4 14 0
Do.	C.S.M.L.	do. do. ...					...	.	17·0	17·0	...	...	4 14 0
3.—POTASSIC. *(a)—Potash as Sulphate.*													
Sulphate of Potash	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.					...	..	..	..	48·6	...	20 11 6
Do.	ML in diamond ..	do. do. ...					...	..	..	..	48·6	...	20 11 6
Do.	C.S.M.L.	do. do. ...					...	...		...	48·6	...	20 11 6
Do.	Cresco	Cresco Fertilisers (W.A.), Ltd.					...			..	48·5	...	20 0 0
Do.	Sun ...	Westralian Farmers Pty., Ltd.					...	..	..	.	48·6	...	20 11 6
(b)—Potash as Muriate.													
Muriate of Potash.	Sickle	Cuming Smith Mt. Lyell F.F., Ltd.					..		.	.	...	50·0	16 11 6
Do.	ML in diamond	do. do. ...					...	.	..	...	...	50·0	16 11 6
Do.	C.S.M.L. ...	do. do. ...					...	.		...	...	50·0	16 11 6
Do.	Cresco .. .	Cresco Fertilisers (W.A.). Ltd					...	.	.	..	...	50·0	16 15 0
Do.	Sun ..	Westralian Farmers Pty., Ltd.					.			.	...	50·0	16 11 0
30 % Potash Salts .	Cresco .. .	Cresco Fertilisers (W.A.), Ltd.					...		...	.	..	30·0	8 10 0
Kainit	Sun	Westralian Farmers Pty., Ltd.					...	..		..	...	14·0	*
Potash Manure Salts ...	do. ...	do. do. ..					...	..	..	..	.	30·0	*
4.—NITROGEN AND PHOSPHORIC ACID.													
Super, and Ammonia ...	Cresco	Cresco Fertilisers (W.A.), Ltd.	.	..	.		...	...	...	...	...	..	...
Potato Manure C	Sickle	Cuming Smith Mt Lyell F.F., Ltd.	..	3·5			15·0	·4	1·6	17·0	...	...	6 6 6
Potato Manure F	do.	do. do. ...	.	6 0		.	13·5	·4	1·6	15·5	...	...	7 1 6
Super. and Ammonia, No. 1	do.	do. do. ...	..	1·5			16·0	·4	2·1	18·5	..	...	5 9 0
Do. do. No. 2	do.	do. do. ...	.	3·5	.	..	15·0	·4	1·6	17·0	...	...	6 6 6
Do. do. No. 3	do.	do. do. ...	..	6·0			13·5	·4	1·6	15·5	...	...	7 1 6

* Prices not available.

FERTILISERS—*continued.*

Name of Fertiliser.	Brand.	By whom Registered.	Nitrogen (N) as:				Phosphoric Acid (P_2O_5) as:				Potash (K_2O) as:		Price per ton on rail at Works or Perth.
			Nitrate.	Ammonia.	Blood & Bone.	Bone-dust.	Water Soluble.	Citrate Soluble.	Acid Soluble.	Total	Sulphate.	Muriate.	
			%	%	%	%	%	%	%	%	%	%	£ s. d.
Potato Manure No. 2 ...	M.L. in diamond ...	Cuming Smith. Mt. Lyell F.F. Ltd.	..	3·5			15·0	·4	1·6	17·0	..	...	6 6 6
Do. No. 6 ..	do. ...	do. do.	.	6·0	..		13·5	·4	1·6	15·5	...	..	7 1 6
Super and Ammonia No. 1...	do. ...	do. do.	...	1·5	.		16·0	·4	2·1	18·5	...	...	5 9 0
Do. do. No. 2...	do. ..	do. do.	...	3·5	.		15·0	·4	1·6	17·0	...	...	6 6 6
Do. do. No. 3...	do ...	do. do.	...	6·0	.	.	13·5	·4	1·6	15·5	...	...	7 1 6
Potato Manure C	C.S.M.L.	do. do.	...	3·5	.		15·0	·4	1·6	17·0	...	...	6 6 6
Do. F	do. .. .	do. do.	..	6·0	.	.	13·5	·4	1·6	15·5	.	...	7 1 6
Super and Ammonia No. 1...	do.	do. do.	...	1·5	.	..	16·0	·4	2·1	18·5	...	...	5 9 0
Do. do. No. 2...	do.	do. do.	...	3·5	..	.	15·0	·4	1·6	17·0	...	...	6 6 6
Do. do. No. 3...	do.	do do.	..	6·0			13·5	·4	1·6	15·5	...	...	7 1 6
5.—Nitrogen, Phosphoric Acid and Potash.													
Potato Manure B	Sickle	do. do.	..	3·75	..	..	14·5	·35	·75	15·6	4·5	...	7 16 6
Do. E	do.	do. do	...	3·50	..		14·0	·30	·70	15·0	8·0	...	8 16 6
Do. G	do.	do. do.	...	3·50	.	..	10·5	·20	·60	11·3	16·0	...	11 6 6
Do. H	do.	do. do.	..	4·00	..	.	12·7	·30	·70	13·7	9·0	...	9 1 6
Do. No. 5 ...	do.	do. do.	...	7·50			7·0	·20	·40	7·6	13·25	...	11 9 0
Orchard Manure	do.	do. do.	...	2·00	.	.	14·0	·40	1·60	16·0	...	5·0	6 19 0
Special Mixture K	do.	do. do.	...	8·34	.		8·4	·20	·40	9·0	...	10·04	10 1 6
Do. KP ...	do.	do. do.	..	6·34		.	10·5	·20	·80	11·5	10·04	...	10 1 6
Tobacco Fertiliser	do.	do. do	..	3·30*	..	.	14·0	·50	1·00	15·5	5·7	...	8 2 6
Potato Manure No. 3 ...	M.L. in diamond ...	do. do.	..	3·75	.	.	14·5	·35	·75	15·6	4·5	...	7 16 6
Do. No. 4 ...	do. ...	do. do.	...	3·50	.		14·0	·30	·70	15·0	8·0	...	8 16 6
Do. No. 7 ...	do. ...	do. do.	.	3·50	.	..	10·5	·20	·60	11·3	16·0	...	11 6 6
Do. No. 8 ...	do. ..	do. do.	...	4·00	..	.	12·7	·30	·70	13·7	9·0	...	9 1 6
Do. No. 5 ...	do. ...	do. do.	..	7·50	..	...	7·0	·20	·40	7·6	13·25	...	11 9 0
Orchard Manure	do. .	do. do.	..	2·00	.	...	14·0	·40	1·60	16·0	...	5·0	6 19 0
Special Mixture K	do. ...	do. do.	.	8·34	.		8·4	·20	·40	9·0	...	10·04	10 1 6
Do. KP ...	do. ...	do. do.	...	6·34	..		10·5	·20	·80	11·5	10·04	...	10 1 6
Tobacco Fertiliser	do. ...	do. do.	..	3·30*			14·0	·50	1·00	15·5	5·7	...	8 2 6
Potato Manure B	C.S.M.L.	do. do.	..	3·75		.	14·5	·35	·75	15·6	4·5	...	7 16 6
Do. E	do.	do. do.		3·50		...	14·0	·30	·70	15·0	8·0	...	8 16 6
Do. G	do.	do. do.	.	3·50	..	.	10·5	·20	·60	11·3	16·0	...	11 6 6
Do. H	do.	do. do.	..	4·00	..	.	12·7	·30	·70	13·7	9·0	...	9 1 6
Do. No. 5 ...	do.	do. do.	.	7·50	..	..	7·0	·20	·40	7·6	13·25	...	11 9 0
Orchard Manure	do.	do. do.	...	2·00	..	..	14·0	·40	1·60	16·0	...	5·0	6 19 0
Special Mixture K	do.	do. do.	...	8·34	...	...	8·4	·20	·40	9·0	...	10·04	10 1 6
Do. KP ...	do.	do. do.	...	6·34	...	.	10·5	·20	·80	11·5	10·04	...	10 1 6

Tobacco Fertiliser	do.	do. do.	3·30*	...	...	14·0	·50	1·00	15·5	5·7	...	8 2 6
Potato Special	Cresco	Cresco Fertilisers (W.A.), Ltd.	4·00	...	...	12·5	·50	·75	13·75	8·75	...	9 10 0
Potato Manure No. 2	do.	do. do.	8·20	...	...	8·2	...	...	8·2	...	10·0	10 10 0
Mixed Manure	do.	do. do.	1·50	...	...	7·1	1·40	13·50	22·0	7·5	...	7 12 6
Vine Manure	do.	do. do.	1·50	...	...	7·1	1·40	13·50	22·0	7·5	...	7 12 6
Orchard Manure	do.	do. do.	1·50	...	...	7·1	1·40	13·50	22·0	7·5	...	7 12 6
Mixed Manure No. 2	do.	do. do.	2·00	...	...	16·5	...	1·0	17·5	5·0	...	7 12 6
Do. No. 3	do.	do. do.	3·00	...	...	14·0	...	...	14·0	6·0	...	8 15 0
Tobacco Manure	do.	do. do.	3·30*	...	...	14·2	...	1·30	15·5	5·6	...	8 7 6
Potato Fertiliser	Swan	Binney & Son	3·20	...	...	10·25	...	2·0	12·25	...	4·0	8 10 0
6.—MISCELLANEOUS.												
Sulphate of Iron	Sickle	Cuming Smith, Mt. Lyell F.F., Ltd.	...	...	...	...	...	...	...	...	...	11 1 6
Do.	ML in diamond	do. do.	...	...	...	...	...	...	...	...	...	11 1 6
Do.	C.S.M.L.	do. do.	...	...	...	...	...	...	...	...	...	11 1 6
B.—ORGANIC.												
(a) Bone and Refuse.												
Blood and Bone	Sickle	do. do.	...	6·0	...	...	...	12·0	12·0	...	...	10 0 0
Do.	ML in diamond	do. do.	...	6·0	...	...	...	12·0	12·0	...	...	10 0 0
Do.	C.S.M.L.	do. do.	...	6·0	...	...	...	12·0	12·0	...	...	10 0 0
Do.	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	5·0	...	...	...	12·0	12·0	...	...	10 0 0
Do.	A.N.A. Surprise	C. A. Kirby & Sons	...	5·5	...	...	4·0	10·0	14·0	...	...	9 15 0
Do.	Wyndham	Wyndham Meat Works	...	6·5	...	10	8·0	3·5	11·6	...	...	9 0 0
Do.	Eclipse	W.A. Meat Exports Co., Ltd.	...	6·0	...	...	...	12·0	12·0	...	...	8 15 0
Do.	A1	Haynes & Clements	...	5·25	...	...	3·0	9·0	12·0	...	...	11 0 0
Do.	Apollo	J. Kitchen & Sons	...	5·25	...	...	3·0	12·0	15·0	...	...	9 10 0
Do.	K.B.M.	John Cherry	...	5·0	...	...	...	9·0	9·0	...	...	9 0 0
Do. (A)	Swan	Binney & Son	...	7·0	...	...	...	15·0	15·0	...	...	12 10 0
Do. (B)	do.	do.	...	6·0	...	...	...	12·0	12·0	...	...	9 10 0
Do.	Star	Gardner Bros	...	5·0	...	...	...	14·0	14·0	...	...	10 0 0
Bone Fertilisers	K.B.M.	John Cherry	...	2·0	...	...	...	14·0	14·0	...	...	7 0 0
(b) Bones.												
Pure Bonedust	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	...	3·5	...	...	22·0	22·0	...	...	11 10 0
Bonedust	C.S.M.L.	Cuming Smith, Mt. Lyell F.F., Ltd.	...	...	3·5	...	...	22·0	22·0	...	...	11 0 0
Do.	W in diamond	Henry Wills & Co.	...	...	2·75	...	6·0	13·0	19·0	...	...	9 0 0
Do.	Eclipse	W.A. Meat Exports Co., Ltd.	...	...	3·5	...	...	22·0	22·0	...	...	7 15 0
Do.	K.B.M.	John Cherry	...	...	2·5	...	...	18·0	18·0	...	...	7 10 0
Bonedust Special No. 1	Swan	Binney & Son	...	...	3·5	...	...	22·0	22·0	...	...	10 10 0
Do. Standard	do.	do.	...	...	2·75	...	...	18·0	18·0	...	...	9 10 0
(c) Other.												
Fish Fertiliser	do.	do.	...	4·5	...	...	...	12·0	12·0	...	...	12 0 0

* Part as Nitrate.

FERTILISERS—*continued.*

Name of Fertiliser.	Brand.	By whom Registered.	Nitrogen (N) as: Nitrate.	Nitrogen (N) as: Ammonia.	Nitrogen (N) as: Blood & Bone.	Nitrogen (N) as: Bone-dust.	Phosphoric Acid (P_2O_5) as: Water Soluble.	Phosphoric Acid (P_2O_5) as: Citrate Soluble.	Phosphoric Acid (P_2O_5) as: Acid Soluble.	Phosphoric Acid (P_2O_5) as: Total.	Potash (K_2O) as: Sulphate.	Potash (K_2O) as: Muriate.	Price per ton on rails at Works or Perth.
C.—MINERAL AND ORGANIC.			%	%	%	%	%	%	%	%	%	%	£ s. d.
Bone and Super	Sickle	Cuming Smith, Mt. Lyell F.F., Ltd.	...	..	...	2·0	13·0	·8	4·7	18·7	...	...	7 4 0
Do.	ML in diamond ...	do. do.	...	..	...	2·0	13·0	·8	4·7	18·7	...	...	7 4 0
Do.	C.S.M.L.	do. do.	...	...	...	2·0	13·0	8	4·7	18·7	...	...	7 4 0
Do.	Swan	Binney & Son ...	...	...	..	1·37	8·0	...	9·65	17·65	...	...	6 0 0
Bone, Super and Potash ...	Cresco	Cresco Fertilisers (W.A.), Ltd.	...	.	..	1·0	11·0	1·0	2·0	14·0	1·0	...	5 5 0
Potato Fertiliser (Bone Basis)	Swan	Binney & Son ...	...	..	...	3·0†	...	...	15·0	15·0	...	2·25	9 10 0
Do. Special ...	do.	do. ..	...	...	..	3·5†	14·0	...	1·0	15·0	...	8·0	9 5 0
Bone, Super and Potash ...	do.	do. ..	...	...	.	1 1	...	...	14·25	14·25	...	1·2	5 10 0
Orchard Fertiliser	do.	do. ..	...	..	...	3·17†	...	...	10·0	10·0	...	5·0	11 0 0
Potato Fertiliser X	do.	do. ...	...	...	...	3·20†	...	...	11·0	11·0	...	...	7 7 6
Domestic Garden No. 1 ...	Wondergrowth ...	W. J. Matthews ..	...	...	3·75†	..	12·0	·30	3·20	15·5	...	...	Sold in small lots only.

† Part as Ammonia.

APPLE EXPORT DURING YEAR, 1934.

GEO. W. WICKENS,
Chief State Supervising Officer.

Representatives of Fruitgrowers' Associations and Fruit Shipping Agents met at Sydney on the 16th, 17th, and 18th November, and strove in conference to find an effective and equitable method of limiting during 1934 the quantities of apples to be shipped to the United Kingdom and Continent of Europe.

The results following on last season's heavy export will still be fresh in the minds of growers. Fortunately, Western Australia was not hit quite so hard as the Eastern States, but all the same some consignments at the latter end of the season did not realise sufficient to cover costs, debits being incurred, and the whole season's output depended mainly for its profit on the rate of exchange.

Apparently the principal reason for low returns was a supply of apples greater than the market could absorb at prices payable to consignors, and the main objective of the meeting at Sydney referred to above was to take such steps as would prevent a similar undesirable experience occurring in 1934.

Australia's export figures during the past three years afford sufficient evidence that matters cannot be allowed to drift any longer, for those qualified to judge state definitely that 5,000,000 cases is the limit that the market can take in one season from Australia at remunerative prices, and the export figures disclose that without some control this quantity will be largely exceeded in the near future.

In 1931 Australia exported to the United Kingdom and the Continent of Europe 3,228,322 cases of apples, in 1932, 4,596,399, and in 1933, 5,563,000. Not only is the export increasing from those States which have in the past shipped regularly each year, but New South Wales and Queensland came definitely into the picture in 1933, and they (particularly New South Wales) are there to stay.

The methods of limitation decided upon were:—

1. Restriction of varieties;
2. Restriction of sizes;
3. Elimination of "plain" grade;

and to bring these into effect a list of names of apples for export, and the sizes, was agreed to, and the Department of Commerce was requested to issue a proclamation prohibiting the export to United Kingdom and the Continent of Europe of apples other than those named.

It will be seen from the list hereunder that the number of varieties still available for shipment reached the very respectable total of 42, and there is no doubt further reductions can, with advantage, be made when growers have worked over to better kinds those which are the least desirable, but although "42" are admittedly too many, this number is a distinct improvement on the "80" of last season.

Western Australian growers will note that all the main commercial varieties produced in this State are on the list, and that the limitation of varieties will not greatly affect us, though there are a few prohibited which used to go forward from here in small quantities, such as—"Commerce," "Ben Davis," Spitzenberg," "Shepherd's Perfection," "Rymer," "Springdale," "Strawberry Pippin," "White Winter Pearmain," and others.

The restriction of sizes will definitely cause a reduction in the quantity available for shipment, and to prevent much heartburning during the next export season it is trusted growers will see that their packers pack only such sizes as are shown on the following list, and that the brands on the cases are a true indication of the

contents. There is no doubt the inspectors will find 3-inch "Cleopatras" being submitted and branded as 2¾ inches; 3¼-inch "Dunn's" branded as 3 inches; and 2-inch of other varieties branded as 2¼ inches, and it must be definitely understood that these wrongly branded cases cannot, as in the past, be corrected on the wharf and sent forward on consignment. A permit to ship will not be granted, and not only will the fruit be shut out but the grower will also be liable for dead freight on the boat if such has been booked on his behalf.

Western Australia has, in the past, only shipped a small percentage of "Plain" grade apples, but in 1934 none will be allowed to go forward, and it behoves all packers to keep prominently in their minds the fact that in "Standard" grade the allowance for blemish is only 10 per cent.

The names of apples and their sizes referred to above are as follow:—

APPLE AND PEAR EXPORT COUNCIL CONFERENCE.

Varieties recommended for Export, 1934.

Dessert Apples.

Australian Beauty	2¼	inches to	2¾	inches
Aromatic	2¼	"	2¾	"
Cleopatra	2¼	"	2¾	"
Cox's Orange Pippin	2	"	2¾	"
Crofton	2	"	2¾	"
Delicious	2¼	"	2¾	"
Dougherty	2¼	"	2¾	"
Gravenstein	2¼	"	2¾	"
Geeveston Fanny	2¼	"	2¾	"
Jonathan	2	"	2¾	"
King David	2¼	"	2¾	"
Lalla	2¼	"	2¾	"
New Town Pippin	2¼	"	2¾	"
Pomme de Niege	2	"	2¾	"
Ribston Pippin	2¼	"	2¾	"
Scarlets	2¼	"	2¾	"
Shoreland Queen	2¼	"	2¾	"
Statesman	2¼	"	2¾	"
Worcester Pearmain	2	"	2¾	"
Yates	2	"	2¾	"
King Pippin	2¼	"	2¾	"
Rokewood	2¼	"	2¾	"
Sturmer	2¼	"	2¾	"
Stone Pippin	2¼	"	2¾	"

Culinary.

Alfriston	2½	"	3¼	"
French Crab	2½	"	3	"
London Pippin	2½	"	3	"
Mobb's Codlin	2½	"	3	"
Prince Alfred	3	"	3¼	"
Reinette de Canada	2½	"	3	"
Stewart's	2½	"	3	"
Schroeder	2½	"	3	"

Dual Purpose.

Alexander	2¼	inches	to 3	inches
Crow's Egg	2¼	"	3	"
Democrat	2¼	"	3¼	"
Duke of Clarence	2¼	"	3	"
Dunn's	2¼	"	3	"
Granny Smith	2¼	"	3	"
Rome Beauty	2¼	"	3	"
Red Rome	2¼	"	3	"
Tasman's Pride	2¼	"	3	"
Nickajack	2¼	"	3	"

THE SAN JOSE SCALE.

Aspidiotus perniciosus (Comstock).

L. J. NEWMAN, F.R.E.S.
Government Entomologist.

The original home of the San Jose Scale (pronounced San Ho say) is China.

It was first recorded as a serious deciduous fruit tree pest in the State of California in the year 1873. Since that time it has been spread to various parts of the world and is now regarded as one of the worst scale insects of deciduous fruits.

Fortunately, the scale was early recognised in this State as a potential danger to the fruit industry. To prevent this, a system of compulsory winter spraying was instituted, which has been successful in keeping the pest within bounds. All areas are not infested. All parts of a tree above ground, including the fruit, are subject to attack.

To further control the spread of this scale, nurserymen are compelled under the Plant Diseases Act to fumigate all fruit trees and other plants with Hydrocyanic Acid Gas.

It has been definitely demonstrated that thorough winter spraying will control San Jose Scale.

There have admittedly been economic factors which have been against the fruit grower, and this may have a tendency to create a slackness in orchard sanitation. This tendency should be checked, as any neglect in this regard will very soon be reflected in the deterioration of the trees and the rapid increase of insect pests. Under conditions of neglect, the San Jose Scale rapidly increases.

In view of the regulations now in force in many countries against the introduction of this scale, there is urgent need for all orchardists to realise the necessity of making every effort to control and, if possible, eradicate this scale. Any fruit found infested with San Jose Scale is rejected as unfit for export.

Before proceeding to deal specifically with the San Jose Scale, let us see just what sort of an insect a scale is, and why it is called such. In what manner, for instance, do they differ from flies and other insects.

In making these peculiar creatures, nature seems to have cut one of her most perplexing antics. Scales we shall see differ from other insects in several ways.

In the first place, the adult male only is provided with a pair of wings. At this stage of his life, the male has no functioning mouth parts and consequently lives only for a very short time.

The female scale never develops wings, but does at all stages possess functioning mouth parts.

When first born, both sexes are equally active and provided with mouth parts. In the short lived active larval stage, they crawl about in search of a desirable place on the host plant to locate themselves.

Many species when once they settle down never move about again during their lives, while others are capable of locomotion until partly full grown and some all their lifetime.

Amongst scale insects there are great differences in appearance and habits. Some like the Mealy Bugs (*Dactylopinae*) secrete a covering composed of a cottony material. Others like the Lecaniums (Black Scale, etc.) secrete a waxy continuous layer, which forms their protection. One group found in Australia forms hard galls of various shapes on the trees. Another group form Hard or Armoured Scales (*Diaspinae*), and includes the San Jose Scale, Red Scale, Mussel Scale, etc. The scale whatever its nature, is only the covering, the true insects being beneath.

Scales are closely related to the Aphidae, both belonging to the order Hemiptera. They are also known as Haustellate insects, that is, their mouth parts are formed for sucking plant juices and not chewing as in the Mandibulate insects, Caterpillars, Beetles, etc.

It has been estimated that there are over 300 species of scales found in Australia. Naturally those that have up to date caused most trouble are the introduced. No native scale at present found here is known as a serious orchard pest. If we take and enumerate the scales found in our orchards and gardens, we will not find any native species. Some of our native species have been introduced into other countries and proved most serious pests. This is the natural result following on the unbalancing of nature. The host scale has been introduced without its natural enemies. The time may come, however, when some of our native scales may become troublesome, owing to the failure of their native food plants, and thus forcing them to seek fresh food plants for sustenance or die out. Nature is very persistent in this respect, and strongly objects to the elimination of any species whether animal or vegetable.

Although present probably throughout the entire temperate and tropical regions, scales attain their highest individual and numerical development in the latter.

It is beyond the scope of this article to allude to, much less describe, the difficult sub-families and sections into which this important family of insects is divided. The ordinary observer will have no difficulty in concluding that a Mealy Bug or a Cottony Cushion Scale is an insect, for he will readily detect its six legs and the action of these as it crawls about. It will not, however, be equally clear that the round or oval fixed scales, which have lost their legs, and do not move again, once they have formed their scale, are just as truly insects and members of the same family. This remarkable difference that obtains between members of the same order and family, is accounted for by the fact, that the female insect does not go beyond the larviform condition (exemplified in other insects by the caterpillar or grub stage), whereas in other members of the same family they early exchange to the pupiform, shedding their eyes, legs and other appendages, merely becoming egg masses.

If by the aid of the point of a needle or penknife the scale is raised, a mass of minute particles will be observed which, under a magnifier, will prove to be so many tiny eggs, or in the case of the San Jose Scale the body of the

mother will be found literally packed with young. As many as 1,500 eggs have been counted, from a single Lecanium. Some scales produce many generations each season, others like the Vine Scale (*Lecanium cymbiform*) and other lecaniums have but one brood.

All scale insects are not oviparous or egg layers, although the majority appear to be. In the case of certain species they are viviparous, that is the progeny are born alive. Amongst the viviparous scales there are locally the Soft Brown (*Lecanium hesperidum*) Red Scale (*Chrysomphalus aurantii*), the San Jose Scale (*Aspidiotus perniciosus*) and others. The young of scales when born or hatched will be found on observation to exhibit marked activity. This free life manifested by the scale insect at a period of its existence when it is still very small, is the explanation of its apparent spontaneous increase upon plants, whereon its presence had previously escaped observation.

Persistent activity throughout life is not, however, a character possessed only by the Mealy Bugs, but is to a degree found to exist among the soft bodied scales (*Lecanidae*), up to that period when the adult female is distended with eggs or young. Locomotion upon the food plant after this period ceases.

The Hard Scales (*Diaspinae*), which include the San Jose scale and others have no power of movement on the plant once the larva settles. The beak is inserted and a scale covering formed. The duration of the active life of members of this sub-family is limited to a few hours or days following its birth, during which it takes no food.

The mouth parts of scales are formed for sucking and are very long, often exceeding in length the body itself. This hairlike organ or probosis is held deeply fixed in the tissue of the plant, and remains so during the entire stationary existence, forming a tube through which the plant sap is imbibed. The mouth is also the medium by which the scale establishes the injurious relationship to the plant, that is of such importance to those interested in their successful culture.

This proves in a general way that a scale is a true insect, which is revealed while in the young larval stages of all species, and in some throughout life, and again with others by the structure of the winged male. The female has apparently become degraded, and possesses little else than the powers of destructive feeding, and reproduction.

A single individual of this interesting group of insects, namely the San Jose Scale (*Aspidiotus perniciosus*), will now be considered.

ORIGINAL HOME.

Every country in which this scale is found repudiates the honour of being the native and original home of this pest. Indirect evidence, however. points to China as the probable native place, it being introduced into other countries many years ago per medium of imported trees, plants and fruits. This goes to prove the necessity of the rigid quarantine laws now in force, and to which some people bitterly object.

It first received its specific name at the hands of the entomologist, Comstock, in 1880 who assigned to it the very appropriate name "perniciosus," meaning highly destructive.

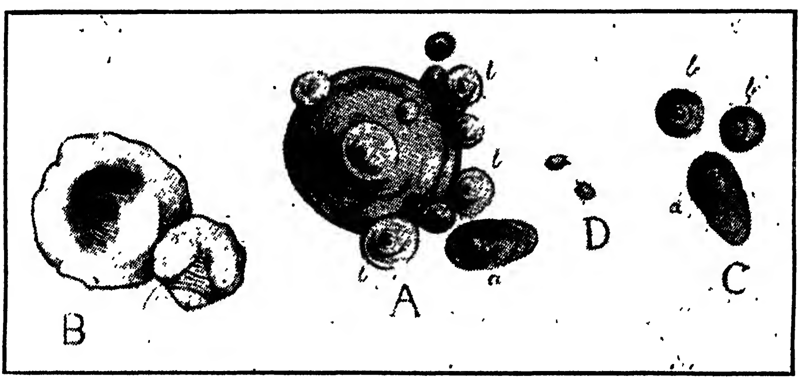
LIFE HISTORY OF SCALE.

From observations made, the following has been noted. The young or larvae are born alive, the eggs hatching within the body of the mother. They are very minute lemon coloured, active creatures. Each larva is furnished with two

feelers or antennae, a long hairlike mouth and six strong legs. When the young has found a suitable place on the plant to settle, it inserts its rostrum or beak through the bark into the juicy sap cells beneath, and draws on same for its sustenance.

Portion of apple branch with San Jose Scale, natural size.

A waxy secretion from the outer parts of its body combined with its cast skins soon forms a covering known as the scale under which the true insect lives. Instead now of the lemon coloured larva we see a greyish slaty coloured object. Even at this young stage the central nipple is generally quite prominent, though sometimes it appears to be wanting altogether. As the insect becomes more mature, the scale becomes darker, and the nipple when exposed slightly golden. Twelve days from birth, the larva has its first moult, and with this casting of the skin the female loses her eyes, feelers and legs, while the male loses his legs and feelers.



A, Adult female scale with immature young of various stages. B, Adult female turned over, revealing the insect beneath, with bristle-like mouth parts exposed. C, Adult male scale. D, Young active larvæ. (Miss A. Hearle.)

The female scale becomes circular and flat and at this period is slightly smaller than the male, whose scale has assumed an oval form. The male of all the circular Aspidiotus scales can always be determined by the oval form. About

seven days after the first moult the male again casts his skin and appears with dark purple eyes and feelers and legs renewed. Two days after the male second moult, the female goes through the same process. At 23 days from birth the male has his third and final moult. Three to five days later, or 26 to 28 days from birth the adult winged male appears.

This issue of the male has been frequently observed by the writer, and is accomplished by the insect backing out from the rear end of the scale. The perfect adult male has two wings, prominent and beautiful antennae, conspicuous purple eyes and anal style, but lacks any mouth parts. He is in fact a most conceited dude, and for this reason we need not be surprised at the lack of anything, even brains. He lives a short and merry life, but owing to the lack of a mouth, misses many of the greatest pleasures in life. He has not even the joy of beholding his own progeny, as he dies before they are born. It may be as well for the family, that they never knew their father as they could not possibly take any pride in their shallow pated parent. To return to the female which is the one we have to fight, and which was left after her second moult. At 31 to 34 days from birth she has her final and adult moult, and seven days later gives birth to living young. Thus we have a life history of four weeks in the case of the male, and roughly five weeks in the case of the female. The male as before stated, only lives a few days after reaching maturity, whereas the female lives and reproduces for several weeks.

The mature females are very prolific, and according to Dr. Howard, of America, the average producing period of a female is six weeks, and the average number of young 400, or 10 every 24 hours. There are at least five generations of this scale per annum.

Infested pear showing typical discolouration and injury to fruit. (Original.)

GENERAL HABITS.

The arrangement or grouping of the San Jose Scale on the bark is often quite characteristic, and is frequently sufficient to fix their identity. In slight infestations they seldom have a tendency to cluster, but are scattered somewhat

evenly on the bark. In badly infested orchards the presence of the scale on new growths, and fruit produces a deep purplish-red colouration in the tissue under the epidermis.

When the scale is bad it is not an uncommon thing to see the scales overlapping one another. Bark that is thickly infested has a grey ashy appearance, due to the presence of the large number of scales, and becomes rough and cracked. It can be proved whether the scale is alive by crushing with a knife or the finger nail. If a yellow oily substance exudes, they are alive, but if no such oily liquid appears after pressure they are dead.

HOW THE PEST SPREADS.

In the first place it is introduced into orchards primarily per medium of young stock, cuttings and scions. Birds and insects have been proved spreaders of this pest. When they alight upon an infested tree the young active larvae crawl on to their bodies and are thus carried about. Man himself may be an agent in its distribution, when picking and working amongst the infested trees; the young fall or crawl onto his clothes, tools, utensils, etc., and are thus conveyed about. Infestation from tree to tree is often accomplished by the blowing about of the tiny larvae. It has been noted that the scale will spread in the line of the prevailing winds. Infested fruit, packed and sold about the country is a possible means of spreading the scale. Growers need to be most particular in this regard, especially when dealing with export fruits, lest a prejudice be created in the minds of importers in other countries against our entire crop, from the fact that it would be branded as coming from an infected country. In fact, many countries have already declared an embargo against the introduction of fruit and plants found to carry this scale.

CLIMATIC CONDITIONS.

As a factor in the spread and increase of this pest, it has been observed for some time that there must be other conditions than mere food supply, to determine the abundance of scale insects in any particular region. As mentioned earlier, this scale has not proved to be as serious a pest in this State as it has in other countries, for which we need to be thankful. It is possible, even probable, that differences in the amount of humidity are of greater importance than extreme temperatures. It is thought, however, the most likely local climatic factor is the period of dryness, with intense summer heat periods, which occurs during most local summers. The same conditions of hot dry winds have a similar effect on the Woolly Aphis. There are no known specialised natural enemies in this State which concentrate upon it.

A casual internal chalcid wasp is bred out under cage conditions, and several species of ladybirds have been noted feeding upon it. Although it has been proved not to be so serious a pest here, it must not be permitted to escape from control, as we do not know what a season may bring forth with regard to insect pests.

METHODS OF TREATMENT.

Extermination, when once the pest has got a start in an orchard, appears to be well nigh impossible, although there are local records of its having been wiped out when taken in time, but, generally speaking, this is not so.

While, therefore, one is undoubtedly justified in asserting that the San Jose Scale is to be a permanency, it by no means follows that the profitable growth of deciduous fruits is seriously menaced on this account. Experience here and in other countries has abundantly demonstrated that this scale insect can be controlled.

In other words, by proper treatment, the value of which has been demonstrated by much practical experience, an orchard may be protected from serious injury and kept in a good paying condition so far as influenced by the San Jose Scale.

There are several methods of control which no attempt will be made to describe here, but this article will be confined to the standard formula as now recommended by the Department.

All deciduous trees throughout the orchard must be thoroughly sprayed while the trees are dormant before the 7th September with one of the following:—

1. A registered brand of Commercial Lime Sulphur Wash, at a strength of 1 gallon of stock to 7 gallons of water; or
2. A registered brand of Prepared Spraying Oil, used at a strength of 1 gallon of spraying oil in 19 gallons of water.

When an orchard has become badly infested with San Jose Scale, two dormant period sprayings are recommended, the first spraying to be completed before the 30th June, the second before the 7th September.

If the Red or Bryobia Mite is also present, Prepared Spraying Oil should be used first and the Lime and Sulphur second. There should be at least one month interval between the application of either of these sprays.

Both sprays at the strengths here advised are for use only on deciduous trees, during dormancy.

It has been proved that the scale in this State can be effectively controlled by one good regular thorough winter application. The lime sulphur spray kills the scale not only by direct caustic action, but also by leaving a limy coating on the trees, which remains for a long time and thereby protects the trees against any young that may issue from adults which escaped the winter action. The spray before application should be passed through a strainer and the pump must be provided with an effective agitator.

In applying lime sulphur spray to some varieties of apples, it has been noted that the hairy nature of the terminal growths, prevents the wash from properly coating the bark. Scales which are situated on this terminal wood, are not always destroyed owing to the hairy protection. The young from these naturally crawl upwards on to the new wood, which has no lime sulphur coating, or in the case of spurs, on to the fruit, so that trees on which the scale has been pretty thoroughly exterminated, may nevertheless present badly spotted fruit. In cases like that it would be wise to spray the terminals with the oil spray.

The wear on pumps and nozzles can be kept to a minimum by carefully washing the apparatus promptly after use. When spraying with the Lime Sulphur, wear only the oldest clothing, and take care to protect the hands, face and eyes, and thus avoid injury to the skin and unnecessary inflammation of the eyes.

In addition to its usefulness against insect pests, Lime Sulphur has proved to be a valuable fungicide.

In conjunction with spraying, orchard culture and sanitation must be practised. Neglected, non pruned, and starving or weak trees are always more susceptible to this scale than those which are healthy and well kept. Trees which are debilitated from any cause whatever, rapidly fail, when brought under the influence of this scale.

Points to remember about spraying for San Jose Scale:—

1. Do not spray when the trees are wet. This weakens the wash.
2. Do not spray just before rain, because the rain will rapidly wash the mixture off before it has time to dry.
3. See that the spraying is done during the dormant period.
4. Test the strength of the Lime Sulphur. If 32 degrees Beaumè, use at 1 in 7 of water; if 28 degrees Beaumè, use 1 in 6 of water.
5. Take advantage of wind, when spraying large trees.
6. Do not skimp the amount of spray. Cover every inch of tree.
7. If trees have hairy tips, it is a good plan to apply the prepared Oil Spray to these parts.
8. Keep spray machine in good repair.
9. Use gloves to save the hands and goggles for the protection of the eyes.
10. Never use Lime and Sulphur wash and Oil sprays together. Allow at least one month interval between the treatments.

PEA WEEVIL (BRUCHUS PISORUM).

Warning.

L. J. NEWMAN, F.R.E.S.,
Government Entomologist.

In visiting various centres in the South-West during October, there was ample evidence of the presence of this pest in the field pea crops.

The eggs, which are oval, yellow bodies, are glued to the exterior of the young pea pods. They are generally deposited singly. As many as 28 eggs were counted on a single pea pod. These eggs are easily observed by the naked eye. Fortunately this pest can be controlled by fumigation, but unless those concerned take a co-operative interest in the work of suppressing this weevil, considerable losses will follow and the pest will become more widespread.

With the object of preventing the spread of this pest per the sale of infested seed, the following Order in Council was gazetted on the 28th April, 1933. This places the onus on the seller of the seed to see that the conditions, as set out in the Order, are carried out. For fuller details *re* life history and treatment, see Leaflet 357.

(*Extract from Government Gazette of 28th April,* 1933.)

AT a meeting of the Executive Council held in the Executive Council Chambers, at Perth, on the 21st day of April, 1933, the following Orders in Council were authorised to be issued:—

Plant Diseases Act, 1914.

ORDER IN COUNCIL.

WHEREAS it is enacted by Section 35 of "The Plant Diseases Act, 1914," that the Governor may make Regulations prescribing all matters which by this Act are required or permitted to be prescribed, or which it may be necessary or convenient to prescribe for giving effect to this Act, and, *inter alia,* prescribing the manner in which plants, fruits, and coverings in which plants and fruits have been contained or packed shall (whether infected or not) be treated in order to eradicate disease or to lessen the risk of the spread of the disease: And whereas certain Regulations were made under the said Act and published in the *Government Gazette* on the 16th day of September, 1921: And

whereas the disease known as Pea Weevil (*Bruchus pisorum*) is existing in Western Australia, and it is now deemed expedient to amend the said Regulations in the manner hereinafter mentioned, in order to prescribe the manner in which field peas produced in or imported into this State shall be treated in order to eradicate the said disease and to lessen the risk of the spread of the said disease: Now, therefore, His Excellency the Lieut.-Governor and Administrator, acting with the advice and consent of the Executive Council and in exercise of the power conferred by the said Act, doth hereby amend the Regulations made under the said Act and published in the *Government Gazette* on the 16th day of September, 1921, by inserting after Regulation 48A a new Regulation as follows:—

48B. No person shall sell, supply, distribute, deliver, or dispose of any field peas (whether produced within or imported into Western Australia) to any other person unless and until such field peas have been fumigated with carbon-bi-sulphide in such manner as effectively to render the same free from the disease of Pea Weevil (*Bruchus pisorum*).

(Sgd.) L. E. SHAPCOTT,
Clerk of the Executive Council.

WEST ARTHUR PASTURE COMPETITION, 1933.

H. G. ELLIOTT,
Agricultural Adviser, Dairy Branch.

The Pasture Competition, 1933, was organised by the West Arthur and District Agricultural Society for the best five acres of pasture exhibited. Judging was carried out from October 24th to 27th by the writer, the results being as follows:—

Competitor.	District.	Yield. 45	Freedom from Weeds. 15	Variety of Useful Grasses. 15	Freedom from Diseases and Insect Pests. 15	Evenness of Growth. 10	Total. 100
J. D. & C. Johnston, "B"	Bokal ...	37	15	13	15	8	88
J. Hatherly	Arthur River	38	13	13	13	10	87
R. Schinzig	Duranillin ...	44	14	5	12	9	84
E. Loynel, "B" ...	Sewell ...	43	13	3	15	9	83
K. Cooling	Duranillin ...	43	14	2	13	9	81
Mrs. Cameron, "B" ...	Collie ...	39	15	4	14	8	80
E. Loynel, "A" ...	Sewell ...	43	11	4	11	7	76
W. Kelliher	Darkan ...	38	12	5	10	9	74
Mrs. Cameron, "A" ...	Collie ...	28	12	4	13	8	65
W. Nicholls	Arthur River	28	13	5	11	7	64
J. D. & C. Johnston, "A"	Bokal ...	29	9	5	11	8	62
T. H. James	Sewell ...	28	10	3	12	6	59
H. Harrison	Bokal ...	24	10	4	11	7	56
F. B Horwood ...	Darkan ...	21	11	5	13	3	53

The rainfalls as recorded during the year at the centres concerned were:—

Centre.	April.	May.	June.	July.	August.	Sept.	October.	Total for Growing Period.
								inches.
Duranillin ...	54	317	444	212	371	169	208	1,775
Collie ...	134	367	1,121	594	416	441	468	3,541
Darkan ...	67	263	424	254	338	199	199	1,744

Messrs. J. D. & C. Johnston's winning entry consisted of Subterranean Clover and Wimmera Rye Grass, planted at the rate of 6 lbs. each per acre on new land, the fertiliser applied being one bag of superphosphate per acre. The land was free from all insect pests and diseases, and also free from weeds with the exception of an odd plant of Yellow Weed (*Bartsia viscosa*). The plot was calculated to yield 11.1 tons of green fodder per acre.

Mr. J. Hatherly's pasture also consisted of Wimmera Rye Grass and Subterranean Clover, planted on a granitic wash soil following on a tobacco crop which received a half ton of fertiliser per acre. The seeding was 10 lbs. Wimmera Rye Grass and 3 lbs. of Subterranean Clover per acre, the fertiliser applied being 90 lbs. superphosphate. Red Mite was the only insect pest, with Prickly Lettuce, Thistle, and Yellow Weed (*Ba tsia sp.*) as weed pests. This pasture was calculated to yield 11.75 tons of green material per acre.

The pasture entered by Mr. R. Schinzig was established during 1926 on land which originally was timbered with White Gum, Jam, Blackboy, and Stinkwood. The pasture was one of Subterranean Clover, with a heavy growth of minor annual grasses such as Brome Grass, Silver Grass, Soft Brome, Barley Grass with some Woolly, Suckling, and Hop Clover incorporated.

The weeds consisted of Cape Weed, Flat Weed, and *Bartsia viscosa.*

Insect pests—Clover Weevil and Red Mite.

The area was topdressed with 90 lbs. superphosphate per acre in the autumn.

The pasture was grazed until the end of August, and was calculated to yield about 12.8 tons per acre.

E. Loynel "B."—The pasture entered by Mr. Loynel was dominantly Drooping Flolwered Clover, grown on White Gum—Blackboy flats. The chief plants incorporated in the Drooping Flowered Clover was Subterranean Clover, Suckling Clover, Soft Brome, Silvery Grass, and Brome Grass.

There was no evidence of any insect pests.

The weeds consisted of Cape Weed, with odd plants of *Bartsia.*

The area was topdressed annually with one bag of superphosphate per acre in the autumn.

This pasture was grazed heavily until the end of August, and was calculated to yield about 12.4 tons of green material per acre.

A number of the remaining plots were of high standard, consisting mainly of Subterranean and Drooping Flowered Clovers. The principal grasses were those of the minor types, such as Spear Grass, Brome Grass, Soft Brome, Silver Grass, Barley Grass, etc.

The chief insect pests were Red Mite, Clover Weevil, and in one field only was Lucerne Flea present.

With regard to the weeds, *Bartsia viscosa,* Cape Weed, Flat Weed, and Wild Pink were the most prevalent.

The highest yielding crop was that of R. Schinzig, which was estimated to yield about 12.8 tons of green material per acre.

The lack of efficient renovation of the pastures with pasture or chain harrows was noticeable on nearly all the fields judged; this, together with irregular topdressing, accounted for the general unevenness in growth.

All competitors topdress their pastures annually, or, in some cases, during the autumn and spring, with superphosphate, at rates varying from 45 lbs. to 2 cwts. per acre per annum.

WEST ARTHUR DAIRY HERD COMPETITION, 1933.

H. G. ELLIOTT,
Agricultural Adviser, Dairy Branch.

The inspection of the dairy herds entered in the West Arthur Dairy Herd Competition, 1933, was made on 24th to 27th October, and awards were made as follows:—

Competitors.	District.	General Condition of Herd.	Dairy Type and Breeding.	Bull Pedigree and Dairy Type.	Heifers and Calves—Condition and Quality.	Sanitation.			Total.
						Milking Shed.	Dairy.	Milking Utensils.	
		30	25	10	15	10	5	5	100
E. Loynel ...	Bowelling	25	21	10	14	8	4	4	86
H. Harrison	Bokal ...	24	19	10	13	6	4	3	79
A. Holmes ...	Duranillin	25	23	9	14	2	2	3	78
T. H. James	Sewell ...	24	21	9	13	5	2	3	77
R. Schinzig...	Duranillin	21	20	9	13	2	2	4	71
J. T. Quill ...	Duranillin	21	19	9	13	2	2	3	69
W Kelliher...	Darkan ...	22g	22g	...	12	5	3	3	67

g No bull; points added to these sections.

Mr. E. Loynel's winning herd consisted of 30 cows, which are being graded up to Jerseys; one pure bred Jersey bull, from Mr. S. P. Herbert's "Nooka" stud at Nungarin; nine excellent grade Jersey heifers, and 20 Jersey calves. All stock were in good condition, and were grazing on good Subterranean and Drooping Flowered Clover pastures. Mr. Loynel conserves large quantities of meadow and oaten hay, and uses dicalcic phosphatic licks during the periods when the pastures are dry.

The milking shed is of the "walk through" type, with concrete floors and has a milking machine installed. The dairy is well ventilated with fly-proof wire doors and windows, also having a good concrete floor.

GENERAL.

The herds judged were found to be in excellent condition and, on most farms, uniformity in type was in distinct evidence. With the exception of one herd, with a Guernsey herd sire, all owners are "grading up" to Jerseys. Pure bred bulls are in use on all farms.

All herds were grazing on good pastures of the annual winter and spring type, consisting mainly of Subterranean Clover or Drooping Flowered Clover, with other annual types of clovers and minor grasses.

TWO PLANTS SUSPECTED OF BEING POISONOUS TO STOCK.

C. A. GARDNER,
Government Botanist.

Losses in stock from coastal areas have frequently been reported, and in some cases have been attributed to poisoning. In this connection suspicion rests upon two plants concerning which there is some evidence to show that at least in certain seasons they are undoubtedly to a greater or less extent toxic. Both plants belong to the genus *Anthocercis*, a genus belonging to the family Solanaceae, which contains other local poison plants, such as Native Tobacco and Pituri.

The genus *Anthocercis* is represented in Western Australia by twelve species, and although Baron von Mueller, a former Government Botanist of Victoria, stated that all are poisonous, this is questionable. At least one species (*A. anisantha*), a loose-growing shrub with white flowers, found around granite rocks in the Eastern districts, is often eaten readily by stock in periods of drought.

In the early years of settlement in Western Australia, a large white-flowered species of Anthocercis (*A. viscosa*) which inhabits the granite rocks of the South coast, was reported as a poison plant in the Albany district. Cattle died from eating it, and following several losses within the townsite area the plant was eradicated. A few shrubs may still be seen on the summit of the hill occupied by the Fort. The plant also occurs on Dempster Head, Esperance, and at various intermediate places, but always associated with granites. The large roundish viscid or gummy leaves, and the large white fragrant flowers make it a readily recognisable species.

The second species is of much wider range. *Anthocercis littorea* extends throughout the littoral tract between the Murchison River and Point Malcolm, near Israelite Bay. It is most common on the limestone sands, and may be seen abundantly between Rockingham and the Hill River, and again on the South coast. It is fairly prevalent to the immediate South of Mount Ragged, on the Balladonia-Point Malcolm track, and in the Geraldton district. This shrub, which is semi-herbaceous, has variously-shaped thick and almost fleshy leaves, usually some short prickles on the stems, and yellow rayed flowers streaked with violet lines in the tube of the flower. Dr. A. Morrison when Government Botanist reported this plant as causing the poisoning of some children in 1899, the symptoms observed resembling those produced by Belladonna, and Turner ("Supposed poisonous plants of West Australia"—Australasian Association for the Advancement of Science vii., 912 (1898) lists this species, together with *A. viscosa,* as poison plants.

To what extent *A. littorea* affects stock on coastal country is yet to be determined. It is probable that the plant is not equally virulent throughout the year, and the matter is one requiring investigation. Until this is done stockmen running sheep and cattle on coastal country would profit by observations upon this plant with a view to its potentialities as a toxic species, and report any such observations.

The accompanying plate gives details of leaf and flower.

EXPLANATION OF PLATE.

Anthocercis littorea Labill.

A. habit. B. leaf. C. & D. flower (slightly enlarged). E. stamens and pistil. F. branch with fruits. A. B. & F. reduced to half size. Icon. origin. King's Park, Perth, W.A.

THE VALUE OF HOME-GROWN FOODSTUFFS TO DAIRYMEN.

L. C. SNOOK, B.Sc. (Agric.),
Agricultural Adviser, Dairy Branch.

Dairy farmers are quite familiar with the advice that all food materials required should be produced on the farm. It is generally recognised that this advice is sound, but advocates of "home production" are often handicapped because they cannot give definite evidence of the value in £ s. d. of commonly unsaleable products such as meadow hay, silage or green maize. When a farmer maintains —as many do—that it does not pay him to grow maize or conserve meadow hay, the best method of conversion is to show how much money will have to be spent to buy the equivalent nutrients in the form of chaff or concentrates. Farmers rarely realise the value of home grown roughages, and the production of these would be greatly stimulated if their true worth were known.

In Table I. will be found a number of alternative daily rations all supplying sufficient nutrients for an average dairy cow (about 800 lb. live weight) producing two gallons of 5 per cent. milk per day. For the sake of simplicity no allowance is made for any food received in grazing—the value of pasture varies considerably. Ration 1 consisting of chaff and bran is used as a standard. A suburban dairyman whose cows received no grazing would have to expend nearly 1s. 2d. on these ingredients to maintain the cow in condition and keep the production up to two gallons. In the succeeding rations, home grown roughages are introduced, and the value of these is determined by a method of substitution. For example, ration 1, costing about 1s. 2d. can be replaced by ration 2 which consists of 24 lb. of meadow hay and 3.3 pence worth of bran. It follows that this meadow hay cannot be worth more than 10½d. or else it would be cheaper to buy chaff. Conversely it is more profitable to use meadow hay than buy chaff so long as it does not cost more than 10½d. per 24 lb. (£4 2s. 4d. per ton) to conserve. In other words, a ton of meadow hay will save an outlay of £4 2s. 4d. spent on chaff. The ability to assess the value of the produce of his labour in definite monetary terms often proves of distinct encouragement to the farmer. In a similar fashion the relative worth of other materials has been computed.

TABLE 1.—ALTERNATIVE RATIONS.

Supplying full Daily Requirements of a Cow of 800lbs. liveweight, Producing two gallons of 5 per cent. Milk per day.

Foodstuff.	lbs. of Foodstuff. lbs.	Dry Matter. lbs.	Starch Equivalent. lbs.	Digestible Crude Protein. lbs.	Value if Purchased. pence.	Cost of Purchased Material. pence.
Requirements	—	18·25	10·90	1·88	—	—
1.—Chaff (good)	20	17·6	7·20	0·84	8·60	8·60
Wheat Bran	8	7·0	3·84	1·04	5·28	5·28
	...	24·6	11·04	1·88	13·88	13·88
2.—Meadow Hay (good mixed)...	24	21·1	8·40	1·27	10·58	...
Bran	5	4·4	2·40	0·65	3·30	3·30
	...	25·5	10·80	1·92	13·88	3·30

Supplying full Daily Requirements of a Cow of 800lbs. liveweight, Producing two gallons of 5 per cent. Milk per day.

Foodstuff.	lbs. of Food-stuff. lbs.	Dry Matter. lbs.	Starch Equiv-alent. lbs.	Digest-ible Crude Protein. lbs.	Value if Pur-chased. pence.	Cost of Purchased Material. pence.
3.—Meadow Hay (good mixed)	20	17·6	7·00	1·08	8·82	...
Oaten Grain	2½	2·2	1·55	0·17	1·33	1·33
Wheat Bran	5	4·4	2·40	0·65	3·30	3·30
	...	24·2	10·95	1·90	13·45	4·63
4.—Meadow Hay (good mixed)...	20	17·6	7·00	1·08	8·82	...
Bran	5	4·4	2·40	0·65	3·30	3·30
Crushed Wheat	2	1·8	1·46	0·18	1·20	1·20
	...	23·8	10·86	1·91	13·32	4·50
5.—Chaff	20	17·6	7·20	0·84	8·60	...
Bran	2	1·8	0·96	0·26	1·32	1·32
Wheat (crushed)	2	1·8	1·46	0·18	1·20	1·20
Linseed Meal	2	1·7	1·40	0·52	3·48	3·48
	...	22·9	11·02	1·80	14·60	6·00
6.—Chaff	20	17·6	7·20	0·84	8·60	...
Crushed Wheat	4	3·5	2·92	0·36	2·40	2·40
Meat Meal	1	0·9	·90	0·60	1·86	1·86
	...	22·0	11·02	1·80	12·86	4·26
7.—Meadow May (good mixed)...	12	10·6	4·20	0·65	5·29	...
Maize (green)	25	5·5	3·12	0·28	3·64	...
Bran	7½	6·6	3·60	0·98	4·95	4·95
	...	22·7	10·92	1·91	13·88	4·95
8.—Clover Hay	18	15·8	6·84	1·62	9·21	...
Maize (green)	32	7·0	4·00	0·35	4·67	...
	...	22·8	10·84	1·97	13·88	*Nil*
9.—Maize (green)	32	7·0	4·00	0·35	4·67	...
Lucerne (bud stage) ...	20	4·0	2·08	0·76	3·04	...
Meadow Hay (mixed) ...	14	12·3	4·90	0·77	6·17	...
	...	23·3	10·98	1·88	13·88	*Nil*
10.—Chaff	25	22·0	9·00	1·05	10·75	...
Lucerne (bud stage) ...	20	4·0	2·08	0·76	3·13	...
	...	26·0	11·08	1·81	13·88	*Nil*
11.—Sudan Grass, 2ft. high (grazed)	50	11·0	6·00	1·45	8·52	...
Chaff	10	8·8	3·60	0·42	4·30	(4·30)
Oats	2	1·8	1·24	0·14	1·06	1·06
	...	21·6	10·84	2·01	13·88	1·06
12.—Silage (mixed cereal and legume)	30	7·5	3·00	0·63	4·45	...
Meadow Hay	16	14·1	5·60	0·86	7·05	...
Bran	2	1·8	0·96	0·26	1·32	1·32
Oats	2	1·8	1·24	0·14	1·06	1·06
	...	25·2	10·80	1·89	13·88	2·38

The cost of purchased foodstuffs varies according to time and place. The values used in preparing the above Table are given in Table II. It may be necessary to adjust these somewhat to coincide with local conditions. For instance, freight on bran is an important factor and, again, wheat is not worth 3s. per bushel to the Wheat Belt farmer, hence this commodity is worth relatively more to him as a stock food than one would infer from the Tables.

TABLE II.

COST OF PURCHASED FOODSTUFFS.

Foodstuff.	Cost Used.	Cost per lb. pence.
Chaff	£4 per ton	0·43
Bran	£5 10s. per ton (short) ...	0·66
Pollard	£6 per ton (short)	0·72
Crushed Wheat ...	3s. per bushel (60 lbs.) ...	0·60
Oats	1s. 9d. per bushel (40 lbs.)...	0·53
Peas	5s. per bushel (60 lbs.) ...	1·00
Linseed Meal	14s. 6d. per 100 lbs. ...	1·74
Meat Meal	15s. 6d. per 100 lbs. ...	1·86

In Table III. will be found the values per lb. and per ton of home grown roughages as computed by substitution in Table I.

TABLE III.

VALUE OF HOME-GROWN ROUGHAGES AS DERIVED FROM RATIONS IN TABLE I.

Foodstuffs.	Value per pound. pence.	Value per ton. £ s. d.
Meadow Hay (Good)	0·44	4 2 4
Clover Hay	0·51	4 15 6
Green Maize	0·15	1 7 2
Green Lucerne (Bud stage)	0·16	1 9 3
Sudan Grass (2ft. high)	0·17	1 11 10
Silage (Mixed Cereals and Legumes) ...	0·15	1 7 8

Having arrived at a value for the various conserved materials, it may prove interesting to apply the results to a typical dairy herd and calculate the saving resulting from the use of such home-grown fodders.

RESULTS APPLIED TO A 20-COW DAIRY HERD.

Thirty-two tons of meadow hay will supply 20 cows with 20 lb. per head per day for six months. This would be worth £132 or £5 1s. 5d. per week for six months. If the value of *good* meadow hay was more generally recognised, it is believed that far more would be conserved.

CLOVER HAY.

Clover hay is one of the most valuable roughages which the dairy farmer can use. It is rich in protein and lime—two essential ingredients which are very often lacking. Thirty-two tons of good meadow hay will provide 20 cows with 20 lb. per day for six months. To purchase the equivalent nutrients would cost almost £6 per week or about £153 in all. This supports the argument that it pays to buy fertilisers to stimulate the growth of clovers and other herbage rather than to purchase foodstuffs in the lean months or allow cows to decrease in milk yield through lack of this fodder. It should be noted that clover hay and green maize can supply all the needs of a two-gallon cow, there being no need to purchase any foodstuff.

SILAGE.

In Ration 12 it will be noted that 30 lb. of silage are required. Assuming that silage is fed for four months of the year, 33 tons would be required to provide 20 cows with 30 lb. each per day. This silage would be worth about £45 or 27s. per ton according to the tables, but on most farms it would be worth much more. Calculations have here been made only on a food unit basis, no credit being given to silage for the valuable properties it possesses as a summer supplement in dry areas. In the Wheat Belt particularly, silage has a high dietetic value as a substitute for green food, which augments the food unit value considerably.

GREEN MAIZE.

Green maize appears in a very favourable light in these tables, and other green crops such as elephant grass or sorghums would obtain equal credit. This partly results from the fact that pasture is not considered. Where grazing or dried roughage is available in the paddock, maize would not be so valuable as here indicated, but where other roughages are scarce, as in suburban dairies, maize approximates in value to 27s. per ton. Green maize also has a dietetic value in addition to its food unit value—cows would yield better on Ration 7, which contains green maize, than on Ration 1 (chaff and bran) even though both rations supply the same number of food units.

If the maize is planted in rotation 2 to 2½ acres would supply 20 cows with 25 lb. per head per day, assuming an average yield of approximately 13 tons per acre (yields of 20 tons are not uncommon). Such a crop, according to Table III., would be worth about £36 or £2 5s. per week.

GREEN LUCERNE.

In contrast to maize, lucerne is somewhat under-estimated in value in the Tables. This apparent anomaly occurs because the rations in Table I. are mainly utilised to satisfy maintenance requirements. Maize is particularly suitable for this purpose, as a much lower percentage of protein is needed for maintenance than for production of milk. Lucerne being rich in digestible protein is eminently suitable to stimulate milk flow, and, when rations for production are considered, lucerne will appear in a much better light. This Queen of summer fodder crops is more akin to expensive concentrates, such as linseed meal, than roughages such as cereal chaff. Lucerne also has a high dietetic value especially where other leguminous products are scarce.

Four acres of lucerne probably will supply ample material to give 20 cows 20 lb. of greenstuff per day for at least six months of the year. Even at the low estimated value given in Table III., such a plot would be worth £8 per month. The remarkable productivity of a small lucerne patch is not generally realised, and even a little lucerne during the summer months is a great stimulant to milk production.

SUDAN GRASS.

Sudan grass constitutes one of the best summer fodders which can be used in this State. It is hardy and drought resistant, and responds well to rotational grazing, each plant stooling out to form a strong tussock. If pure seed is used, sudan grass can be grazed at all stages of growth without any risk of sorghum poisoning, and cows will produce well while grazing on this fodder. The value of sudan grass is well shown in the tables—eight acres sown to sudan and yielding

in the aggregate 10 tons of greenstuff per acre would be worth almost £130. Sudan grass is a cheap fodder to grow, and the produce does not require irksome handling as is the case with maize and lucerne.

From the foregoing it is quite apparent that the use of home-grown materials will result in considerable saving. The question of pasture has been avoided in this article, but it may be stated that a two-gallon cow on good mixed pasture should require no other food. As a matter of interest, it may be stated that the author has seen cows on good mixed pasture consistently yield 3½ to 4 gallons of milk per day without receiving any supplementary feeds other than hay. Good pasture is the best and cheapest food a cow can be given.

Some interesting information on the relative value of concentrates also can be gleaned from Table I. For example, Ration 5 shows that linseed meal makes the ration of a low-producing cow very expensive. In Ration 6 it will be seen why meatmeal has been advocated as a protein supplement—it is the cheapest protein concentrate on the market and, despite an initial dislike, cows will learn to eat this material which is only required in small amounts. Several farmers have advised that some cows will eventually eat meatmeal readily even when unmixed with any other material.

BEE STINGS—THEIR TREATMENT.

A CURE FOR RHEUMATISM.

H. WILLOUGHBY LANCE,
Apiculturist.

Many persons suffer unnecessarily from bee stings through lack of knowledge of how to deal with bees or how to treat the injury when stung.

Bees, like any other stock, vary in temperament, some strains being very vicious, attacking any intruders that come near their hives, but the majority are quiet and harmless until they are interferred with. When bees are gathering nectar or water, they concentrate on their job and take no notice of passers-by.

MANIPULATING HIVES.

The trouble usually starts when hives are interfered with, especially when there is a dearth of nectar. In opening up a hive, all movements should be slow and deliberate, injuring as few bees as possible, and not damaging combs of honey. Injured bees or honey from broken combs arouse the bees and put them on the defensive. Haste or signs of fear in the operator are quickly detected by the bees and may cause them to attack by dozens. If this should occur, walk away, passing behind bushes into a shady spot or building, and the bees will gradually be left behind.

If a bee succeeds in driving home its fiery dart, remove it as quickly as possible, but do not pull it out. The little white substance which is visible is the bag containing the poison, and if this is seized the poison is squeezed through the very small hollow tube into the flesh. The best way to remove it is to push it out sideways with the finger nail or the point of a knife.

REMEDIES FOR STINGS.

If honey is at hand, rub a little of this on to the stung spot. With some persons this is quite sufficient to counteract the formic acid of the sting, but others require further treatment. One of the best remedies is a little bi-carbonate of soda, which most housewives keep for cooking purposes, about as much as will go on a 6d. piece, dissolved in a cup of hot water. Bathe the injured spot for some time, keeping the water as hot as possible, then rub in a good ointment, such as Rexona, Zambuk, etc. Repeat again in half an hour. This is quite harmless to the eyes or any portion of the body.

If discomfort persists, or any ill effects are felt, dissolve as much bi-carbonate of soda as will go on a threepenny piece in hot water, and drink. This may be repeated three hours later.

Other remedies are—the old-fashioned blue bag, a raw onion, ammonia, soda, tobacco juice, etc., but the bi-carbonate of soda will probably be found the most efficient.

To a beekeeper of any standing, stings are a part of his regular work, and he takes very little notice of them, as he has become so inoculated with the formic acid as to be nearly or quite immune. Cases have occurred, however, where beekeepers who have for many years been immune, have, in later life been very badly affected by stings and unable to work with bees.

MECHANISM OF THE STING.

It may here be worth considering the mechanism of the sting and the nature of the bee venom.

The stinging equipment of the bee consists of two glands which secrete the poison, a sack or reservoir for storing the poison, and the sting (which is a modi-

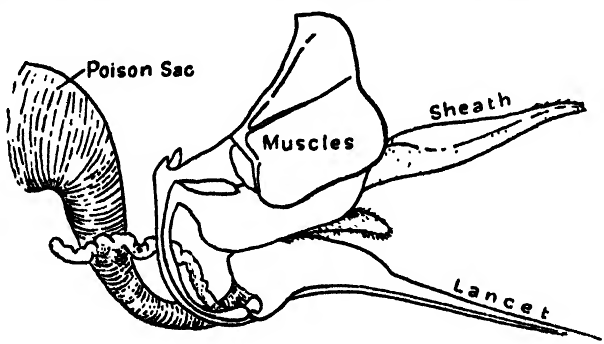
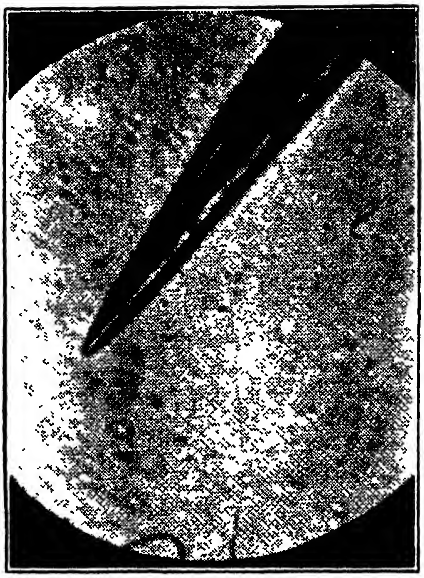


Fig. 1.

From "The Bee World."

fication of the ovipositor of ordinary insects). This sting itself, which is a wonderful instrument, consists of three main parts—a hollow, sharp-pointed, barbed lancet; the sheaths; and the muscles which actuate it. (See Figure 1.) The lancet

is sharper than the finest razor, stiffer than the best steel, yet non-brittle and flexible to the finest degree. At the tip of the sting the canal measures one-twelve-hundredth of an inch. (See Figure 2.) The whole action of the sting is a compli-



The tip of the sting magnified 600 times.

(From "Gleanings in Bee Culture.")

cated one. Suffice it to say that the muscles of the sting cause a backward and forward movement of the lancet, and at the same time cause a pumping action on the poison sack and inject the poison through the hollow tube into the punctured part.

BEE POISON.

The poison or venom is produced by two "acid" glands—long tubes with a tiny gland at the tip of each. Here the main bulk of the poison is produced and passed into the poison sack where it is stored. Then, as it is being ejected through the sting, it is joined by a small admixture from "alkaline" glands. Investigations by Langer and Flury show that the poison is a very complicated chemical substance and not only formic acid.

RESULT OF BEE STINGS.

The normal result of a sting is a small red area at the point where the sting entered surrounded by a larger white area. The actual pain at the seat of the sting usually only lasts a comparatively short time; with many persons this is followed later, as the poison spreads, with swelling around the injured part and irritation. Most beekeepers, however, become partially immune to the swelling and irritation and only feel the insertion of the sting like a red hot needle, so that a few minutes

after do not know where they have been stung. The human body, as is well known, is able to develop substances which neutralise poisons that are received in small quantities. These substances are known as "antitoxins." The blood of the average beekeeper contains antitoxins to bee poison which neutralise and form a remedy for bee stings. All, however, are not so fortunate, and even beekeepers have been known to become "sensitized" instead of "immunized."

Sensitized persons who are not used to being stung sometimes show serious and dangerous effects, such as shock and collapse, severe swelling and difficulty of breathing, or a hot flush, trembling, and great anxiety. These effects, however, are rare.

REMEDY FOR SERIOUS CASES.

Dr. Ray Jones, of Seattle, has made a close study of assembled medical knowledge of insect bites and stings. He states that in critical cases frequent hypodermic injection of one to one-thousand solution of epineprine prove effective, but that epineprine (formerly known as "adrenaline") is worthless unless given hypodermically. Sensitized persons may obtain immunity by a series of injections gradually increasing in strength. This treatment should, of course, only be given by doctors. For the average person, the remedies first mentioned usually give relief.

MEDICAL VALUE OF BEE VENOM: CURE FOR RHEUMATISM.

Bee venom fortunately has its beneficial side, and is a certain cure for many kinds of rheumatism. Dr. F. Thomson, England, states that "those types which come under the heading of muscular rheumatism—lumbago, fibrositis, and sciatica—are completely or partially cured in a large proportion of cases (the writer himself was thus cured in six weeks after 20 years suffering), and the writer kept a hive of bees in a small back yard behind his consulting room for curative purposes.

"At first one sting is administered, and if the patient is one of that very small band of unfortunates who are seriously affected by bee venom, this treatment is at once stopped.

"If the effects of the sting are normal, however, one or two stings twice weekly are advised.

"In other and more chronic forms of rheumatism, especially where definite joint changes have occurred, the proportion of beneficial results is small; but the method is well worthy of trial, and surprising cures are sometimes obtained.

"In some cases, too, the complications of sub-acute rheumatic fever yield to this form of treatment.

"The sting need not necessarily be applied to the part affected, though this often has a moral effect on the patient; the forearm is usually most convenient.

"The patient, further, may continue the treatment himself, by permission, at the nearest apiary."

Dr. Thompson states that 80 out of every 100 cases of rheumatism may be cured by a course of bee stings, but chronic forms of arthritis are not improved thereby.

In Germany there are several institutions that inject the bee venom hypodermically as a remedy for rheumatism. In Western Australia there are quite a number of person who have been cured of rheumatism by the simple method of allowing themselves to be stung by bees.

CALF CLUB MOVEMENT IN WESTERN AUSTRALIA.

G. K. BARON-HAY,
Superintendent of Dairying.

The Calf Club movement in Western Australia is comparatively recent, but indications are that the number of clubs which will be formed in the near future will rapidly increase.

The first Calf Club was inaugurated at the Yanmah School by the Head Teacher, Mr. Rourke, working in co-operation with the Agricultural Adviser for the district, Mr. M. Cullity. The first Field Day was held in November, 1931, when 40 calves were paraded for judging.

In 1933 Calf Clubs were formed at a number of centres throughout the South-West from Denmark to Boyanup. The credit of conceiving the holding of a Championship Calf Club Field Day must be given to the Donnybrook Dairy Farmers' Association working in close touch with Mr. M. Cullity of the Dairy Branch, Department of Agriculture. A Championship Field Day was held at the Donnybrook Show Ground on the Show Day organised by the Agricultural Society on November 15, 1933, when calves from nine District Calf Clubs were paraded before the judge. The calves, although mostly from grade cows, evidently had been excellently trained and prepared for the day. The ring craft shown by the children indicated weeks of training which would have enabled these stock to be paraded at any Agricultural Show in the State with credit to the owners.

I.—First Calf Club Parade in Denmark District. The Carmarthen Calf Club, November, 1932.

The conversation which the writer had with the parents from various centres indicated that uniform rules and conditions for each district were required, and a number of requests have been received for rules governing the formation of such Calf Clubs and which have prompted this article.

The idea of organising Calf Clubs is to imbue children with a love of animals—to create in them an interest in agricultural life and also develop a sense of responsibility. It has been found in other States, and by the interest evinced by adults in the parades which have been held in Western Australia, that not only do these Clubs tend to develop interest among the children but that parents and their friends also become deeply interested in the movement, and thereby a community spirit is developed with a strong bias towards the dairying industry.

It is essential for the success of a Calf Club that some active and enthusiastic resident of the district should be appointed the Club leader. In this respect the Head Teachers of the various schools have shown themselves keenly interested in the movement and, by reason of their influence with the children, generally make most suitable Club leaders. The Head Teacher also is able to supervise record books and correlate the ordinary subjects of the school curriculum with the work. This branch of rural education has the full support of both the Education Department and the Department of Agriculture, and the best results can only be obtained where close co-operation obtains.

II.—Memory Peak, Boyanup School Calf Club, and her champion heifer "Dawn." On the right is the First Prize, donated by G. F. Combs, Esq., "Brookvale," Jardee.

Dam, Brookvale Topper's Lulu: Production 4,438 lbs. Milk, 250 lbs. Butter Fat as senior 2-yr. old.

The following suggestions regarding the formation of Calf Clubs have given good results during the last two years:—

When it is desired to form a Club in a district, whoever is mainly interested (this may be an organisation or often the district School Teacher) should call a meeting of parents and others interested. The objects of a Calf Club should be explained, which are briefly as follows:—

(1) To create an interest in agricultural pursuits and, in this instance, to especially develop a dairying outlook in the community.

(2) To teach children the value of care and attention to feeding and the rearing of young stock.

(3) To develop a sense of responsibility among children.

All the work involved in feeding, grooming and looking after the calf should be performed by the youthful owner. This will develop a spirit of reliance and—ultimately—of pride in his own herd.

(4) A record book giving a weekly record of the life of the calf and also a detailed statement of revenue and expenditure should be kept. This phase of agriculture generally needs special encouragement.

(5) A spirit of healthy rivalry and desire to excel is created, and members by meeting on Field Days are taught to become competent judges and to appreciate the faults in their own stock as well as the good points, which develops broad-mindedness and tolerance among the children.

III.—Masters T. A. Langridge, W. H. Langridge and Miss I. M. Langridge—First, Second and Third respectively in the parade from five Calf Clubs organised by the Donnybrook Dairymen's Association.

While it is not possible to lay down rules which may be applied in toto for each district, the following are suggested:—

(1) The Calf Club shall be called the....................Club.

(2) A committee of five members shall be appointed, the convenor of the meeting or the Head Teacher of the School to be Chairman.

(3) A meeting shall be held once monthly.

(4) It shall be the responsibility of the committee to arrange for lectures, Field Days, and the conveyance of members where necessary, also to arrange for an Annual Field Day and any general Club business that may arise.

One or more keen and practical farmers may be appointed to visit and assist the children with advice and to see that calves are being correctly reared by the children.

It is suggested that only heifer calves shall be owned by Club members. This facilitates judging at field gatherings, and heifers are less likely to injure children.

Club members shall be grouped into two divisions:—

(a) Children under 8 years.

(b) Children from 8 to 16 years.

(5) A record book should be kept giving a careful account of the rearing of the calf and any other particulars thought desirable, also with a record of expenditure and receipts.

(6) Every member should undertake to exhibit stock at the Annual Field Day.

(7) At the Annual Show calves shall be judged according to the following points:—

Pure breed type or dairy type	50 points.
Appearance and age development	20 "
Leading and ring craft	15 "
Book-keeping and records	15 "

This scale allows 50 points for the quality of the calf, whilst 50 points are allotted for the work carried out by the member. This is to avoid the owner of an excellent "breed type" calf winning the prize even although the calf may not have been reared as well as animals of less high quality.

Field Officers of the Dairy Branch, Department of Agriculture, may be consulted at all times regarding the formation of Calf Clubs and can assist by lectures and demonstrations in the judging of, and systems of rearing, young dairy stock.

IV.—His Excellency, the Lieutenant-Governor, Sir James Mitchell, K.C.M.G., presenting "Brookvale" and his pedigree to Memory Peak, owner of the champion's calf.

THE SUPPRESSION OF BUSH FIRES.

By A. C. SHEDLEY, B.Sc., Dip. For.

(Published by the courtesy of the Australian Broadcasting Commission, being an educational talk given through Station 6WF.)

Fire control organisation is a local problem, but certain broad principles have general application, and the two most important are undoubtedly early detection of outbreaks, and rapid transport of a fire fighting force to the scene of the fire.

It may be interesting to learn of the methods adopted to locate fires in this and other countries.

Under W.A. conditions in the forest areas early detection is secured by the erection of lookout towers on high points at intervals of 15 to 20 miles apart, and these are manned continually during the summer months.

The method of locating a fire in general use is by the cross bearing system; the bearings taken from two lookout towers being transmitted over the telephone to headquarters, where they are plotted on a district plan. The intersection of the bearings gives the position of the fire which in this case can be roughly placed without actually being seen.

In some cases only one tower is manned when fires are spotted by the use of the range finder. With the single range finder system, the exact location of a fire cannot be obtained unless the actual site can be seen from the tower, because it is only possible to range on to some definite object such as a tree and not smoke.

The position of fires hidden by ridges from the tower, and the higher smoke only of which can be seen; can only be estimated, but the tower man from his knowledge of the country and familiarity with the panorama after he has been stationed on the tower for some little time can give the position of the fire with extreme accuracy.

On occasion when the fire danger is particularly acute or the visibility very poor, owing to the pall of smoke, it has been found necessary to send out patrols to aid in location. In Victoria the Forests Commission is assisted on such days of abnormally bad weather conditions by the Air Force sending out aeroplanes equipped with wireless apparatus chiefly for detection purposes. In Canada, the use of aircraft both for detection of fires and transport of personnel and equipment to fires has developed tremendously and is now generally recognised as the only effective method in those parts of the Northern forest country where the topography is not rugged and where the interspersed lakes provide numerous landing grounds.

In cleared country in the agricultural districts, the detection of fires is a comparatively simple matter, because of the uninterrupted view afforded by the clearing.

Having located it, the next step is to reach the fire, and the sooner it is reached the easier will it be extinguished. Before leaving for the scene of the outbreak, however, if possible word should be sent to neighbours in order that no time is lost in securing assistance.

To deal effectively with a bush fire it is necessary to know that a fire burns in one of two general ways: 1. A long oval; when burning before a wind it always starts with a narrow area and travels more or less rapidly with an ever broadening area; 2. Circular; where there is little or no wind it burns slowly away from the starting point with equal intensity in all directions.

Except when the atmosphere is absolutely still, every fire has three distinct parts (1) the head fire; (2) side fires; and (3) the tail fire.

The head fire is the portion which travels before the wind; it is most active, most destructive and the most rapidly moving portion.

Before attempting to do any fire fighting, reconnaissance should be made to determine the extent and head of the fire, topography of the country, the location of any burnt areas, swamps, etc., into which the fire might be "headed," highly inflammable areas to be avoided, and the position of tracks or roads which might be used in back firing.

Bush fires should invariably be attacked from the front to control the head fire first, otherwise this is continually making a wider line and a greater volume. It is rarely possible to work fast enough from behind to overtake the head fire.

Fire travels fastest up-hill, and that portion travelling up-hill being assisted by the natural draught upwards develops into a head fire and must be dealt with as such.

It is seldom that direct beating of the head fire can be undertaken with any hope of success in any bush other than that burnt 12 months or 2 years previously. Raking tracks or making use of existing roads from which to back fire is the only safe method in inflammable bush, grass or stubble country unless of course night fire fighting is carried out. Anyone who has had to do with fire control is well aware of the fact that under normal circumstances, the late night or early morning hours are those during which fire intensity is least. This is due to the higher relative humidity; the lower temperature, and the decreased wind velocity. There are, however, difficulties in fire fighting in the darkness, but miners' acetylene head lamps have been tried and found very helpful.

Tools used for attack are rakes, which are invaluable, shovels for cutting scrub and covering burning logs and some sort of beater, either a dense bush cut from a green tree (a marri or red gum bush is very useful), bags or a specially made beater recommended by the Bush Fire Brigades in South Australia. The latter, which are most useful in clean country, are made of leather 12in. x 8in. firmly secured to a strong, but light handle, and are found to be much more effective than bushes or bags.

The beating should always be directed at the extreme edge of the burning and towards the burned area so that sparks may not be spread to the unburned ground.

The patrol of fires to "mop up" (to use an old war term) after the first attempt at extinguishing them is a very important duty, because of the necessity of dealing with fresh outbreaks as they occur, and only reliable men should be detailed for such work. In back firing also it is necessary to patrol the fire to see that it does not cross the often narrow path which has been made by raking.

For use in clearing a narrow track on rocky ground from which to burn back, the Forests Department has developed a horse drawn scraper which can be constructed by any country blacksmith. It consists of a six foot length of railway rail (45 or 60 lbs.) bent at an angle of 60 degrees to form two sides of a triangle. The use of this scraper eliminates much hand raking.

The main method of attack therefore must be counter-firing from existing or improvised fire lines, particularly in scrub country where it is impossible to come within at least a chain of the highly inflammable scrub. Where it is possible to get close to the fire in grassed areas, or where the scrub is light, or at night when the fire is being put out, a method in use is to extinguish the fire with earth thrown on with long-handled shovels, and with a little practice extreme accuracy of aim and efficiency of distribution of the earth is obtained.

Experiments with knapsack tanks for water have been conducted by the Forests Department and two trucks have been fitted with water tanks and semi-rotary pumps with hose lead.

It has been found that the use of water is far more efficient than soil, and has given every satisfaction; it is possible for a man to extinguish the fire as fast as he can walk, even in thick scrub but it is necessary for the water carriers to be followed up by a second wave of 'moppers up" sweeping in the burned edges, as "flash-backs" are common, and if not watched may nullify the efforts of the gang putting out the fire; in this connection, it is of course necessary for every method to be followed up to deal with "flash-backs," which are more common with water than when soil has been thrown on the fire. The advantage of the use of water lies in the fact that it is much more rapid in its effect than soil.

The one big disadvantage with the knapsack tanks is that the supply of water is not inexhaustible, and valuable time is lost in refilling. This can be overcome in part by the provision of reserve supplies of water in tanks placed as close as possible to the actual site of the attack. One very valuable use for these tanks lies in the ability of the men using them to get close enough to a fierce outbreak to cool it down sufficiently to enable a man with a shovel to approach and extinguish it with soil or by beating.

The knapsack tank consists essentially of a 4-gallon galvanised iron container to which is fitted a short length of hose and hand pump with nozzle by means of which a stream of water can be forced a distance of 20 or 30 feet. It has been found invaluable for extinguishing burning logs and trees which are a constant source of danger in starting fresh outbreaks if not effectively controlled.

In addition to these knapsack tanks, water tanks with semi rotary pumps mounted on motor trucks and spring carts operate in forest districts for fire protection. They have proved very useful as they can be stopped some distance from a blaze and yet the water can be forced on to the fire. Tanks could be used with advantage in country districts if they were provided at convenient centres where they could be loaded on to lorries when required.

Tests are being conducted in W.A. with chemicals, the most important of which is potassium carbonate dissolved in water in varying amounts to an imperial gallon and used in the knapsack tanks. It has been found that even with a 3lb. solution the fire is blackened right out, and does not break out again as it frequently does when water alone is used. Also the solution will put out a greater area of fire, resulting in a saving of water, an important factor in the dry areas of the State.

To deal with the bush fire problem in country districts, co-operative effort is absolutely essential if effective control is to be achieved, and for this purpose bush fire brigades have been formed all over Australia.

In Victoria as far back as 1931, the number of bush fire brigades had reached 224, and these organised voluntary brigades are now distributed throughout the populated sections of the State. Self help in all cases has been encouraged and each brigade provides its own equipment, usually by a levy on landowners at the rate of 1s. per 100 acres, whilst in some cases a membership fee of approximately 10s. per annum is charged to members. In the case of brigades operating in the vicinity of forest reserves, however, the Forestry Commission assists by a donation of certain apparatus, stipulating that members help with the extinguishing of fires in adjacent State forests.

In South Australia, a number of brigades have been formed, the chief of which are those in the vicinity of Wirrabara and Jamestown in the north where a very high standard of efficiency has been reached, and good work accomplished both from the point of view of the farmers and the Forests Department in minimising the losses caused by bush fires of many thousands of pounds. In these centres the settlers have become quite enthusiastic as they realise that proper fire organisation is the only way to combat the bush fire menace.

The South Australian Amended Bush Fires Act of 1913, gave the necessary power to District Councils—corresponding to our Road Boards—to appoint up to ten persons as special officers whose duties are to prevent and control fires. These officers or fire controllers, as they are called, are granted very wide powers in case of outbreak of fire in the particular district in which they are appointed. The Controller is empowered to take any action he may think fit in combating an outbreak of fire, and can authorise the burning of a fire break to stem an approaching fire or to use other preventative measures, which at times might mean the burning of another man's property.

In the case of some districts committees are also appointed, the duties of the members being to rally forces to the scene of action, undertake the responsibility of provisioning all of the fire fighters with food and drinking water. A depot is established in each main township at which a supply of water containers and fire beaters is kept ready for action.

The committees also undertake propaganda work and the distribution of linen posters bearing the name and addresses of fire controllers and committeemen with instructions to the public as to how to proceed in case of an outbreak of fire. In addition, valuable advice is given to farmers in the district about the ploughing of firebreaks, the protection of homes, stables, etc., the provision of fire fighting equipment and bush fires legislation.

DAIRY CATTLE IMPROVEMENT ACT, 1922, and AMENDMENT ACT, 1932.

G. K. BARON-HAY,
Superintendent of Dairying.

The Dairying Industry in Western Australia may be said to have passed through two very definite periods:—Firstly 1895-19, may be conveniently called the "**Stationary Period,**" and secondly 1919-1933, the "**Period of Growth.**"

The following figures indicate the position in 1919-20 quite clearly:—

TABLE No. 1.

Number of Cows	42,563	
Milk Production	9,619,238 gallons.	
Yield per Cow	226 Gallons milk = 90·4 lbs. Butter Fat.	
Acres of Sown Pasture ...	16,672	
Acres per Cow	·39	
Imports of Butter	6,606,099 lbs. (approx.) at 2s. 3d. lb. ...	£743,175
" Cheese	1,143,005 " at 1s. lb. ...	£57,150
" Condensed and Dried Milk	3,508,501	£127,689
		£928,014

The picture presented by these figures is anything but a cheering one.

The yield per cow was exceedingly low and made dairy farming quite unprofitable except at uneconomically high prices for produce, which as a matter of fact, were ruling at the time, the average price for butter fat during 1920, being approximately 2s. 3d. per lb. Moreover, the area of pasture available per cow unit in the State was only .39 acres, while on the average dairy farm an area of 4.75 to 5 acres is required to provide a sufficiency of fodder for a cow unit.

It appears obvious that in 1919-20 there were two very weak spots in the economic position of the industry, namely:—(1) Inadequate arrangements for feeding the cow; (2) The low average production of dairy cows.

Improvement, it was thought could be brought about by improved "Feeding" methods and a definite policy of "Breeding."

The object of the present article is to show what results have been obtained from measures to strengthen the second of the weak spots mentioned above.

It is generally recognised that a definite policy in "Breeding" is essential before any permanent increase in average or individual production can be obtained. The policy of using registered pure-bred sires to improve the average yield of the progeny of common stock has been proved time and again.

Only one striking example as illustrating the effect of this policy on large numbers of dairy cows need be given:—

TABLE No. 2.

25,000,000 COWS IN THE UNITED STATES OF AMERICA.

——	Percentage Pure-Bred Bulls.	Average Production of Milk per Cow. Gallons.
1st Group of 12 States	51 ...	410
2nd Group of 12 States	31 ...	330
3rd Group of 12 States	19 ...	260
4th Group of 12 States	12 ...	200

This shows the result from dividing the United States of America into four groups of twelve States each, according to the percentage of pure-bred bulls heading dairy herds, in a census taken 10 years ago.

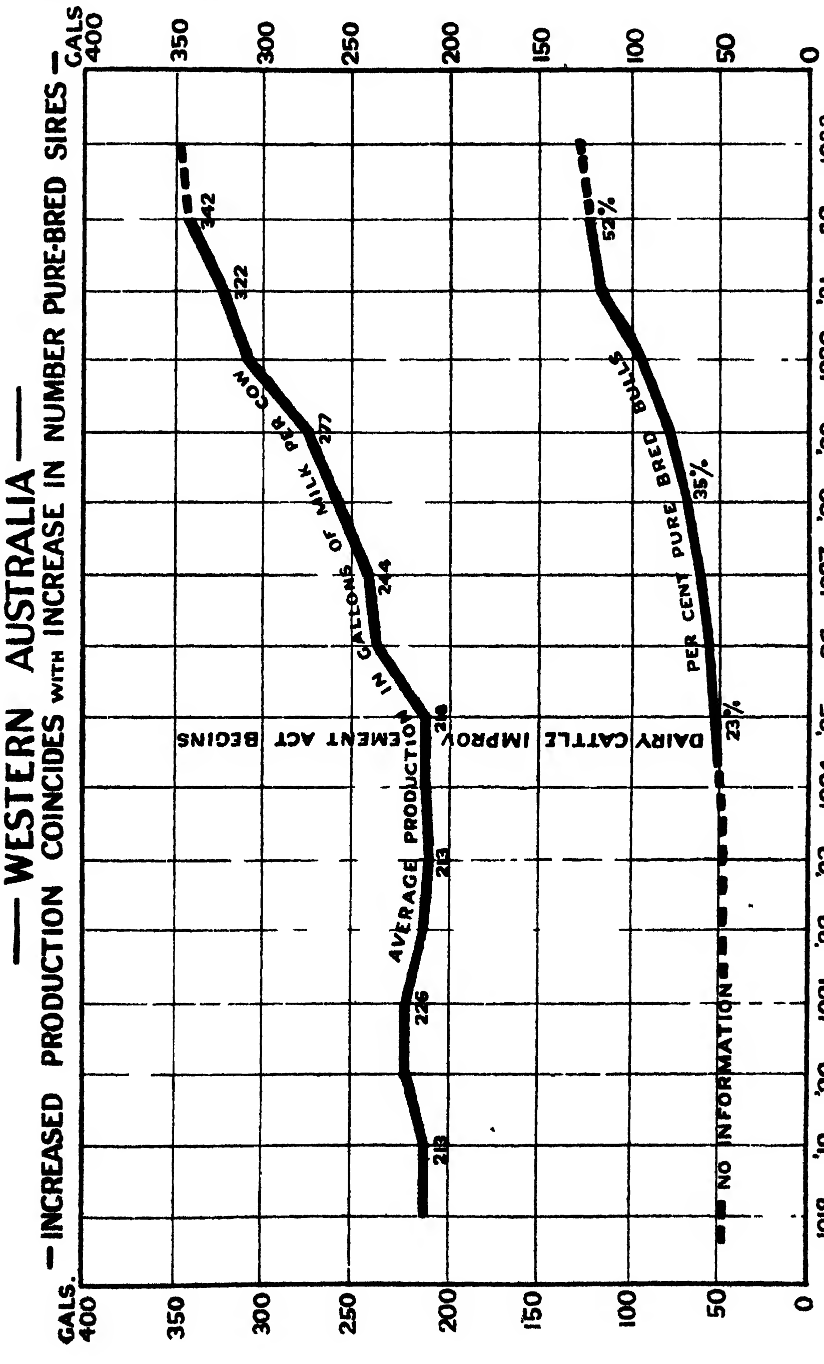
Group No. 1 with an average of 51 per cent. pure sires, recorded an average production of 410 gallons of milk per cow per annum; Group No. 2 with an average of 31 per cent. pure sires, showed an average production of 330 gallons per cow; Group No. 3 with an average of 19 per cent. pure sires averaged 260 gallons per cow, and Group No. 4 with an average of 12 per cent. pure sires, showed an average production of 200 gallons per cow. These figures, representing as they do, the result of the production of nearly 25 million dairy cows should be of importance elsewhere in showing that increased production follows the use of pure-bred sires.

It is instructive to compare the position in Western Australia in 1919 with that in 1932, as is shown in Table No. 3:—

TABLE No. 3.

Year.	Gallons of Milk per Cow.	Percentage Pure-Bred Bulls.
1919–20	226 ...	20 (estimated)
1924–25	218 ...	23
1928–29	277 ...	35
1929–30	316 ...	...
1930–31	322 ...	...
1931–32	342 ...	52

It will be noted from Table No. 3 and more clearly from the Graph below that the yield of the average cow in Western Australia has increased by 57 per cent. during the period, whilst the percentage of pure-bred bulls has steadily increased from 23 to 52.



Undoubtedly increased pasture available has contributed to the improvement, but it must be noted from the Graph that between the years 1918 and 1925 no increase in the average production is discernible, although there was a very big increase in the acreage of pasture available, namely, from 20,000 acres to over 80,000. This is a further indication of the premise mentioned before that the foundation of all permanent increase in production is along the lines of "breeding," as however much fodder is available for cows whose capacity for production is low, the desired increase will not be obtained. It will further be noticed from the Graph that the steady upward trend in production commences with the introduction of the "Dairy Cattle Improvement Act."

The following information regarding the requirements under the Act is given for the information of those farmers who are not yet conversant therewith.

Dairy farmers generally uphold the provisions of the Act as it is recognised that by the adoption of the principles underlying its administration the average production per cow will be increased and, conversely the average cost of production will be decreased.

1. The prescribed area for the operation of the Acts is the **South-West Division** of Western Australia (which is that portion of the State that can be bounded by a line drawn from a point on the West coast slightly north of Gantheume Bay, eastward along the Murchison River to Ballinoo Spring, due south to Tallering Peak; south-east to Mt. Gibson. east to the No. 1 Rabbit-proof Fence, south along the Fence to Burracoppin, thence south-east along the Fence to the south coast at approximately Bedford Harbour).

2. The Acts provide that **ALL BULLS OVER THE AGE OF NINE MONTHS** in the area described in paragraph No. 1, **MUST BE REGISTERED**, with the exception of pedigree beef strain animals kept solely for beef production, which may be exempted on application to the Director of Agriculture.

CERTIFIED PURE-BRED BULLS should be registered for **LIFE**, the fee being **10s. per head.** This refers to bulls whose parents are entered in the Breed Herd-book.

GRADE BULLS should be registered **ANNUALLY**, the fee being 5s. per head with each application. This registration refers to all animals for which no pedigree can be produced or whose parents are not in the Herd-book.

3 The prescribed fee should be forwarded with each application.

4 Registrations are **due on 1st January** and should be effected not later than the 21st; new registrations become due as the bulls reach the age of nine months throughout the year.

5. Registrations of **Grade** bulls should be renewed annually on or before the 21st January. The **registration year** dates from **1st January to 31st December,** irrespective of when effected during the year.

6. Owners should notify the Department in writing, quoting the disc number, immediately any registered bull is,

(a) **Transferred**—in which case the name and address of the new owner should be furnished;

(b) **Sold for slaughter, castrated or deceased,** in order that the registration may be cancelled

7. **Failure to register** or to notify the Department in accordance with paragraph No. 6, constitutes an offence against the Act, rendering the offender liable to a penalty of £20.

8. The disc number should be quoted on applications for re-registrations.

9. When lodging an application for the first time the applicant should supply, if possible, the name of the previous owner and the breeder.

10. In the event of application forms not being available the particulars may be submitted by letter, but full details of breeding, age, etc., should be furnished.

11. **No disc can be transferred to a bull other than the animal** for which it is issued, and once registered a bull retains the same disc number even though he may change ownership.

The disc should be attached to the left ear, and in the event of sale, should be passed on to the purchaser, together with the certificate of registration.

12. Registration may be refused unless the bull be well grown according to age, sound in constitution and manifestly showing evidence of the breed characteristics of one of the following dairy breeds:—

Ayrshire, Jersey, Friesian, Red Poll, Guernsey, Dexter Kerry, Holstein, Milking Shorthorn, Kerry.

By carefully observing the foregoing, owners will greatly facilitate the administration of the Act.

LIVE STOCK AND MEAT.

For the information of readers of this "Journal," the following particulars have been supplied by Messrs. Elder, Smith, & Co., Ltd., Perth:—

COMPARATIVE NUMBERS OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS FOR MONTHS OF SEPTEMBER, OCTOBER, AND NOVEMBER, 1933.

—	September.				October.				November.				
	6th.	13th.	20th.	27th.	4th.	10th.	18th.	25th.	1st.	8th.	15th.	22nd.	29th.
Sheep...	12,870	12,992	14,238	15,734	19,125	13,241	17,027	17,816	17,326	18,871	12,778	9,569	10,333
Cattle	578	475	529	445	405	511	637	723	661	605	626	558	544
Pigs ...	1,440	1,325	1,785	1,801	2,126	1,127	2,123	1,681	1,664	1,502	1,227	1,155	1,264

COMPARATIVE VALUES PER POUND.

Mutton	4¾d.	4¾d.	4¾d.	4½d.	4d.	2¾d.	3½d.	3½d.	3d.	2¾d.	2½d.	3d.	3½d.
Beef ...	3¾d.	3½d.	4d.	4¾d.	5d.	5½d.	5½d.	4½d.	3¾d.	4d.	4d.	3½d.	3¾d.
Pork ...	5¾d.	5½d.	5¾d.	5¾d.	5¾d.	5¾d.	5¾d.	5½d.	5d.	5¼d.	5½d.	5¾d.	6½d.
Bacon	5½d.	5½d.	5¾d.	5½d.	5d.	5d.	5d.	5d.	4¾d.	5d.	5½d.	5½d.	5½d.

MARKET REPORT.

Messrs. H. J. Wigmore & Company, Limited, of Wellington Street, Perth, have supplied the following information regarding the chaff, oats and wheat available for auction at the Perth Railway Yards, for the period September to November inclusive.

September.—720 tons of chaff. F.a.q. to prime was selling freely at £5 2s. 6d. to £5 10s.; f.a.q. at £4 15s. to £5 per ton. Mediums were finding buyers at £4 7s. 6d. to £4 10s. Prime oaten chaff was selling at £5 2s. 6d. to £5 5s.; f.a.q. at £4 15s. to £4 17s. 6d.; mediums from £4 7s. 6d. to £4 10s. per ton.

Oats.—Good heavy feeds were changing hands at 2s. 3d. to 2s. 4d.; good feeds from 1s. 10d. to 2s. 1d.; light feeds from 1s. 6d. to 1s. 7½d. per bushel.

Wheat.—F.a.q. was realising from 3s. 4d. to 3s. 5d.; second grade from 3s. to 3s. 2d. per bushel.

October.—730 tons of chaff. F.a.q. to prime wheaten chaff was making from £5 to £5 5s.; f.a.q. from £4 12s. 6d. to £4 15s.; medium quality from £3 15s. to £3 17s. 6d. per ton. Prime oaten chaff changed hands at £4 17s. 6d. to £5 2s. 6d.; f.a.q. from £4 10s. to £4 15s.; mediums at around £4 5s. to £4 7s. 6d. per ton.

Oats.—Good heavy feeds found buyers from 1s. 11d. to 2s.; good feeds from 1s. 9d. to 1s. 10d.; light feeds from 1s. 6d. to 1s. 8d. per bushel.

Wheat.—F.a.q. was making from 3s. 0½d. to 3s. 1d.; second grade from 2s. 9d. to 2s. 10d. per bushel.

November.—665 tons of chaff. At the beginning of the month f.a.q. to prime wheaten chaff was selling at £4 12s. 6d. to £4 15s.; f.a.q. from £4 7s. 6d. to £4 10s. per ton; mediums at £3 7s. 6d. Towards tho end of the month new season's wheaten chaff was finding its way on to the Perth markets, and consignments of f.a.q. to prime were selling at £3 17s. 6d. to £4 5s.; f.a.q. form £3 12s. 6d. to £3 15s. per ton. Prime oaten chaff was changing hands at £4 10s. to £4 12s. 6d.; f.a.q. from £4 2s. 6d. to £4 5s.; mediums at around £3 12s. 6d. per ton.

Oats.—Fair supplies were arriving for auction, and the market eased. Good heavy feeds were realising from 1s. 10d. to 1s. 11d.; good feeds from 1s. 7d. to 1s. 9d.; light feeds from 1s. 5½d. to 1s. 6½d. per bushel.

Wheat.—F.a.q. was finding buyers at 2s. 11d. to 3s. 0½d.; second grade from 2s. 6d. to 2s. 9½d. per bushel.

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	SEPTEMBER.						OCTOBER.						NOVEMBER.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	73·0	84·8	47·6	38·5	1·35	1·62	74·5	89·6	50·1	42·0	1·63	0·97	89·1	104·7	59·7	46·7	0·28	0·31
Geraldton	72·6	87·8	52·7	44·0	·74	1·37	73·7	91·0	56·4	45·0	1·81	0·71	84·3	103·0	61·7	46·2	0·01	0·25
Walebing	68·5	83·6	44·9	35·3	1·32	2·17	72·4	90·0	45·9	35·4	1·86	1·37	85·1	105·2	55·4	41·2	0·30	·52
Perth	68·6	86·7	50·4	44·0	2·62	3·45	69·2	83·0	53·0	42·0	5·09	2·19	80·3	99·2	59·1	47·6	0·24	0·78
Kalamunda	68·0	83·8	48·6	42·1	3·49	4·72	67·1	87·0	50·5	40·9	5·34	3·12	81·1	104·2	56·6	44·3	0·20	1·00
Bunbury	66·8	82·7	48·1	42·0	3·27	3·64	67·9	80·7	51·0	39·3	3·68	2·41	75·9	91·2	53·9	40·0	0·22	0·99
Bridgetown	67·2	85·0	41·5	32·0	4·00	3·97	68·8	82·0	46·0	34·9	4·46	2·97	78·8	97·0	46·7	35·0	0·50	1·12
Albany	65·3	79·0	48·8	43·0	3·69	4·18	67·6	83·0	50·2	43·6	6·26	3·19	70·0	81·6	53·5	43·4	1·77	1·43
Merredin State Farm	69·8	83·8	43·2	32·3	·49	1·13	74·0	94·5	46·4	3·23	·85	·91	77·2	100·7	55·4	43·0	0·42	0·43
Northam	70·6	87·6	44·9	37·0	·88	1·63	72·7	89·6	48·2	38·0	1·86	1·03	84·9	104·3	55·4	44·8	0·05	0·38
York	69·7	85·8	41·9	34·0	1·15	1·61	72·2	90·0	46·3	36·0	2·21	1·08	83·2	103·0	52·8	40·0	0·05	0·41
Narrogin State Farm	65·8	79·6	42·7	36·0	1·50	2·24	67·9	84·7	44·8	33·8	1·90	1·47	79·9	99·6	49·4	34·6	0·07	0·54
Katanning	65·2	81·0	43·0	34·6	1·56	1·97	67·8	81·3	46·6	36·7	2·22	1·55	77·9	98·0	49·9	37·2	0·59	0·66
Cape Leeuwin ...	64·4	81·8	54·1	47·0	4·05	3·47	64·5	76·8	55·1	45·0	5·23	2·88	69·0	90·0	57·8	49·5	0·61	1 22

QUARTERLY NOTES.

September rainfall was generally below the average, and at the end of the month crops generally were in need of a good soaking rain. October 1 to 4 saw these rains materialise; the falls being immensely valuable to both early and late sown crops. At the end of the month crops were everywhere well forward and on the whole, gave promise of excellent yields. November was a month of very slight rainfall except at the end of the month, when thundery conditions prevailed and fairly heavy rain fell over some of the North and North-Eastern country with hail, which caused considerable damage at a few sections. No doubt these rains did a certain amount of harm, but on the other hand, the water catchments, which were low would have been replenished. Harvesting was in full swing with good results. The cold weather with occasional rain had hindered farmers to a great extent, while owing to the heavy winds, losses through grain shedding had occurred.

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE

LIST OF BULLETINS AVAILABLE FOR DISTRIBUTION.

No. 20.—*The Pruning of Fruit Trees.* J. F. Moody. Price 2s. 6d.
No. 38.—*Linseed or Flax and It's Cultivation.* Geo. L. Sutton.
No. 46.—*Fruit Packing and Marketing and Exporting of Fruit.* J. F. Moody and J. Ramage. Price 1s. 6d.
No. 49.—*The Feeding of Horses.* Professor Paterson and G. L. Sutton.
No. 57.—*Vermin Destruction.* A. Crawford.
No. 60.—*The Farmer's Clip.* J. J. Mahood.
No. 68.—*Flaying and Treatment of Hides.* R. E. Weir.
No. 74.—*Tobacco Cultivation.* A. R. C. Clifton.
No. 79.—*Sheep on the Wheat Farm and their Management in W.A.* H. McCallum.
No. 84.—*Tomato Culture in Western Australia.* E. T. Morgan.
No. 88.—*Light Land: Conference.* G. L. Sutton.
No. 90.—*Stock Waters: Standard for Composition of.* E. A. Mann.
No. 91.—*Dairy Premises.* P. G. Hampshire.
No. 93.—*The Home Tanning of Sheep and other Skins.* H. Salt.
No. 99.—*Australian White.* G. L. Sutton.
No. 101.—*Cotton Cultivation.* G. L. Sutton.
No. 103.—*Kerosene Method for Eradicating Zamia Palm.* G. K. Baron-Hay.
No. 105.—*Pedigree Selection of Seed.* G. L. Sutton.
No. 113.—*Picked Pieces: Classification of Clip.*
No. 114.—*Blue Mould on Citrus Fruits.* W. M. Carne.
No. 115.—*The Value of Windmills for Pumping Water in W.A.* A. H. Scott.
No. 116.—*Spotted Wilt of Tomatoes.* W. M. Carne.
No. 117.—*Cream.* P. G. Hampshire.
No. 119.—*Take-all and Similar Diseases of Wheat and How to Control Them.* H. A. Pittman.
No. 121.—*Mildew Septoria Leaf Spots and Similar Diseases of Cereals.* W. M. Carne.
No. 124.—*Government Inspection of Wheat.* G. K. Baron-Hay.
No. 125.—*Buy Good Seed—Advice to Farmers.* W. M. Carne.
No. 126.—*The Rusts of Cereals.* W. M. Carne.
No. 128.—*Woolly Aphis Parasite.* L. J. Newman.
No. 131.—*The Strength of Wheat and Flour and Its Determination.* R. G. Lapsley.
No. 135.—*The Objects and Conditions of Farmers' Trials.* Geo. L. Sutton.
No. 136.—*The Use of the Scythe.* H. Campbell.
No. 137.—*Fruit Fly—A Further Series of Trapping or Luring Experiments.* L. J. Newman and B. A. O'Connor.
No. 138.—*Clearing Heavily Timbered Areas for Pasture in the South-West.* A. B. Adams.
No. 140.—*Surface Drainage with The Martin Ditcher.* A. R. C. Clifton.
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